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THE
FARMER'S CALENDAR.

1851
BY ARTHUR YOUNG.

DESCRIBING THE
BUSINESS NECESSARY TO BE PERFORMED ON VARIOUS
KINDS OF FARMS DURING EVERY MONTH IN
THE YEAR.

ENTIRELY RE-WRITTEN TO PRESENT DATE.

BY

JOHN CHALMERS MORTON,

EDITOR OF

"THE AGRICULTURAL GAZETTE," "CYCLOPÆDIA OF AGRICULTURE,"

"NEW FARMER'S ALMANACK," ETC.

NEW EDITION.

With Numerous Illustrations.

LONDON :
FREDERICK WARNE AND CO.
BEDFORD STREET, COVENT GARDEN.

1867.

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INTRODUCTION.

So much of the original work has been cancelled in this edition of it, that the editor has to apologize for his title-page. The serial publication of the book was begun before he had realized how much of the "Farmer's Calendar," written more than half a century ago, is obsolete. And the name of Arthur Young has been thus unwittingly committed to an almost entirely new book, not one twentieth part of which is his authorship.

During the quarter of a century which has elapsed since the last edition of his work, agriculture has benefited by scientific research, by mechanical ingenuity, by extended resources, and by increasing skill, vastly more than during any similar period in our history. Fertility has been increased by the operation of new processes, and of new implements; by the importation and the manufacture of new manures; by the cultivation of new plants; and by the maintenance of a larger stock of improved animals. National Societies have stimulated and directed improvements, by publishing both failures and successes; and there are now, from agriculturists and from scientific men, abundant records and satisfactory explanations of every branch and kind of agricultural experience. No wonder that any attempt to describe the practice and experience of the farmer now-a-day should force one almost entirely out of the track pursued by the agricultural writer of a previous generation.

Besides abandoning most of what Arthur Young had written for the guidance of the farmer fifty years ago, the plan of his work, generally adhered to, has been so far altered as to admit one new feature of considerable importance. Farm practice depends on climate and the weather more than on any other thing whatever. Great pains have been therefore taken to present in as condensed and compendious

a form as possible weather tables of the different months at many different stations in the United Kingdom. Readers can thus determine how far the practice of one locality may be advisable in another. And to further supplementary remarks on this subject this introductory statement must now, for the most part, be confined.

The Climate of Great Britain.—Information on this subject has been given in the text with reference to twenty-one selected stations in England. Monthly tables of temperature and rainfall are given for each of these stations. The object has been not to furnish a work on the meteorology of England, but to give such information regarding the usual weather of a number of characteristic points as will enable the reader, wherever he may be placed, to judge of his own circumstances as enabling him to adopt any practice in farming that answers elsewhere, or to judge of those circumstances of climate elsewhere which may justify or explain peculiarities of farm management there. For these tables the editor is indebted to Mr. E. J. Lowe, of Highfield House and Beeston Observatory, Nottinghamshire, one of the most experienced of English meteorologists, who has undertaken the labour of collecting and correcting the immense number of observations, whose results are here compiled.

The twelve monthly tables of English weather given in this volume almost explain themselves:—To take, for instance, the line in each relating to Mr. Lowe's own station:—The mean temperature at Highfield House, as given in column 1, in every table, is the average of 51 years' observations in the shade. In column 2 the lowest mean temperature of each month that has occurred in that period is recorded; and in column 3, the highest. Column 4 gives the greatest heat in the shade: column 5 gives the lowest maximum heat of each month during the period: column 6, the highest minimum temperature during the period.—Taking Highfield House in the month of July for an example, the table shows that the mean temperature is 61.3° , and that it has been as high as 68.4° , and as low as 55.5° —a range in mean temperature of nearly 13° ; the greatest heat has reached 91° in one year, and in another it did not rise above 77° ; the greatest cold has been as low as 36.3° , and as high as 50.4° ; the average amount of rain has been $2\frac{1}{2}$ inches, reaching, however, in one year $4\frac{1}{2}$ inches, and not exceeding $\frac{3}{4}$ of

an inch in another ; the average number of rainy days has been 15, yet varying from 7 to 21 days.

Climate of Scotland.—It remains to give on the same authority figures descriptive of the weather at ten stations in Scotland. The observations at Bressay are by the Rev. Z. M. Hamilton ; those at Sandwich Manse, Orkney, by the Rev. C. Clowston (the mean temperature given here is over thirty-four years, from 1827 to 1861) ; those at the House of Tongue are by Mr. J. Crawford, factor to the Duke of Sutherland. The observations at Stornoway are by Mr. J. Kerr, inspector of works to Sir J. Matheson, Bart. ; those at Culloden, Inverness-shire, are by Mr. Arthur Forbes ; those at Perth by General A. Lindsay, C.B. The observations at Lochgilphead, are by Mr. J. Russell ; at Edinburgh, by Mr. J. Horsburgh, for Captain Stotherd, R.E. ; at Milne-Graden, Berwickshire, by Mr. W. Renwick, gardener to D. Milne Home, Esq. ; at Drumlanrig, by Mr. J. McIntosh, gardener to the Duke of Buccleuch.

The Scotch tables being similar to those of England, require no explanation. They commence in the far north with the Shetland and Orkney Islands, and join the English stations in the South, and the Irish stations in the S.W. In Scotland the observations (with the exception of those in Orkney) are of five and six years' duration, extending from 1856 to 1861. When consulting these returns it is necessary to remember that height above the sea gives a greater or less temperature. The British Association balloon experiments prove that a diminution of 1° Fahrenheit takes place with every increase of 276 feet elevation, and that this law is sufficiently accurate for all elevations in Great Britain or Ireland. Thus, taking October as example, at Culloden the mean temperature is recorded 46.7° ; at Braemar, near it, but 1100 feet above the sea, it was 43.2° ; add for elevation 0.5° and 4.0° respectively, and the temperature of Culloden becomes 47.2° , and that of Braemar also 47.2° ; the difference in the two returns being due to elevation. Returns have been sent from Braemar, by Dr. J. Cameron and Mr. J. Arthur, but it has not been possible to use them. At so great an elevation, however, they are of less interest agriculturally than as a matter of science. Observations at Otter House, Lochfine, Argyllshire, by Dr. W. Rankin, have also been reluctantly omitted.

WEATHER TABLES FOR SCOTLAND, FROM 1856 TO 1861.

LOCALITY.	Height above sea level.	Mean tempe- rature.		Lowest tempe- rature.		Highest mean tempe- rature.		Greatest heat.		Lowest maxi- mum heat.		Highest mini- mum cold.		Greatest cold.		Average amount of rain.		Smallest amount of rain.		Average number of rainy days.		Smallest number of rainy days.		Greatest number of rainy days.			
		Dgs.	Dgs.	Dgs.	Dgs.	Dgs.	Dgs.	Dgs.	Dgs.	Dgs.	Dgs.	Dgs.	Dgs.	Dgs.	Dgs.	Inches.	Inches.	Inches.	Inches.	days.	days.	days.	days.	days.	days.		
January.																											
Bressay, Shetland Islands ...	25	39.4	36.8	36.6	42.0	42.0	55.0	49.0	48.0	28.0	28.0	15.0	5.4	2.8	8.6	14	13	19	13	19	13	19	13	19	13	19	
Sandwick Manse, Orkney Is.	94	38.4	33.6	33.6	42.4	42.4	50.9	46.8	46.8	37.4	37.4	24.4	4.2	9.1	7.5	22	18	25	18	25	18	25	18	25	18	25	
House of Tongue, Sutherland	40	38.6	36.6	36.6	41.2	41.2	53.0	48.0	48.0	30.0	30.0	20.0	4.5	2.5	6.4	17	13	31	17	31	13	31	17	31	13	31	
Stornoway, Lewis Island	70	38.8	36.0	36.0	40.8	40.8	51.0	48.0	48.0	30.0	30.0	25.0	4.5	2.8	6.6	25	15	31	15	31	15	31	15	31	15	31	
Culloden, Inverness-shire ...	104	37.7	35.2	35.2	40.7	40.7	52.8	47.0	47.0	29.7	29.7	19.6	2.1	1.3	3.3	20	13	26	13	26	13	26	13	26	13	26	
Perth	66	39.0	35.2	35.2	42.8	42.8	58.0	53.0	53.0	28.0	28.0	10.0	2.8	1.9	3.9	15	13	17	13	17	13	17	13	17	13	17	
Lochgillhead, Argyllshire	65	38.4	34.1	34.1	42.5	42.5	58.0	47.0	47.0	28.0	28.0	17.0	4.5	3.0	5.5	20	14	25	14	25	14	25	14	25	14	25	
Edinburgh, Ord. Surv. Office	307	39.7	37.4	37.4	42.6	42.6	54.7	53.0	53.0	30.0	30.0	18.8	1.0	0.3	1.8	11	8	13	8	13	11	8	13	8	13	11	8
Milne-Graden, Berwick	100	37.1	34.8	34.8	39.2	39.2	55.0	52.0	52.0	25.0	25.0	9.0	2.0	0.4	4.7	10	4	18	4	18	10	4	18	4	18	10	4
Drumlanrig, Dumfriesshire...	186	36.9	34.6	34.6	40.2	40.2	55.0	48.0	48.0	23.0	23.0	2.7	6.0	4.0	9.0	19	17	22	17	22	19	17	22	17	22	19	17
February.																											
Bressay, Shetland Islands ...	25	41.1	38.6	38.6	44.6	44.6	55.0	49.0	49.0	27.0	27.0	20.0	2.7	0.2	4.7	14	4	22	4	22	14	4	22	4	22	14	4
Sandwick Manse, Orkney Is.	94	39.1	31.6	31.6	43.0	43.0	50.2	47.1	47.1	30.9	30.9	18.4	3.0	0.7	5.6	17	10	25	10	25	17	10	25	10	25	17	10
House of Tongue, Sutherland	40	38.9	36.5	36.5	40.8	40.8	55.0	47.0	47.0	31.0	31.0	19.0	2.1	1.0	3.3	15	7	24	7	24	15	7	24	7	24	15	7
Stornoway, Lewis Island	70	38.5	35.8	35.8	40.5	40.5	52.0	45.0	45.0	30.0	30.0	20.0	3.8	1.9	5.7	19	8	27	8	27	19	8	27	8	27	19	8
Culloden, Inverness-shire	104	38.7	34.0	34.0	41.4	41.4	54.4	46.2	46.2	30.8	30.8	18.7	1.0	0.4	1.7	14	10	18	10	18	14	10	18	10	18	14	10
Perth	66	40.1	37.5	37.5	42.6	42.6	56.0	49.0	49.0	29.0	29.0	-3.0	1.6	0.9	2.4	12	6	17	6	17	12	6	17	6	17	12	6
Lochgillhead, Argyllshire ...	65	38.8	35.6	35.6	41.2	41.2	54.0	47.5	47.5	27.0	27.0	16.0	2.7	0.8	4.2	17	4	24	4	24	17	4	24	4	24	17	4
Edinburgh, Ord. Surv. Office	307	39.7	36.2	36.2	42.6	42.6	55.8	49.7	49.7	29.0	29.0	20.2	0.7	0.4	1.0	9	5	16	5	16	9	5	16	5	16	9	5
Milne-Graden, Berwick	100	37.6	34.6	34.6	40.0	40.0	55.0	48.0	48.0	24.0	24.0	16.0	1.1	0.4	2.0	8	5	13	5	13	8	5	13	5	13	8	5
Drumlanrig, Dumfriesshire...	186	37.3	33.1	33.1	41.0	41.0	56.0	47.0	47.0	18.0	18.0	11.0	4.5	2.6	7.1	14	7	22	7	22	14	7	22	7	22	14	7
March.																											
Bressay, Shetland Islands ...	25	39.1	37.1	37.1	42.0	42.0	59.0	46.1	46.1	29.7	29.7	23.0	5.1	2.9	8.1	19	11	24	11	24	19	11	24	11	24	19	11
Sandwick Manse, Orkney Is.	94	40.2	36.3	36.3	45.1	45.1	53.0	48.4	48.4	31.7	31.7	22.0	2.7	2.7	5.4	25	22	29	22	29	25	22	29	22	29	25	22
House of Tongue, Sutherland	40	40.3	38.7	38.7	41.8	41.8	58.0	54.0	54.0	31.0	31.0	24.0	4.3	3.1	5.4	20	13	29	13	29	20	13	29	13	29	20	13
Stornoway, Lewis Island	70	39.2	36.7	36.7	41.2	41.2	52.0	50.0	50.0	30.0	30.0	21.0	5.4	2.8	7.6	26	19	31	19	31	26	19	31	19	31	26	19
Culloden, Inverness-shire	104	40.5	38.1	38.1	42.7	42.7	58.1	51.0	51.0	31.5	31.5	23.6	2.3	1.4	3.1	23	20	26	20	26	23	20	26	20	26	23	20
Perth	66	43.9	39.4	39.4	47.4	47.4	65.0	54.0	54.0	30.0	30.0	18.0	2.8	1.2	3.8	16	8	22	8	22	16	8	22	8	22	16	8
Lochgillhead, Argyllshire ...	65	40.2	38.0	38.0	42.4	42.4	57.0	51.0	51.0	31.5	31.5	21.0	4.8	3.1	7.3	21	13	29	13	29	21	13	29	13	29	21	13
Edinburgh, Ord. Surv. Office	307	42.5	40.7	40.7	45.5	45.5	61.3	53.3	53.3	31.4	31.4	20.5	2.6	0.7	1.6	13	7	19	7	19	13	7	19	7	19	13	7
Milne-Graden, Berwick	100	40.8	38.8	38.8	44.5	44.5	61.0	52.0	52.0	29.4	29.4	18.0	2.6	2.1	3.1	12	8	16	8	16	12	8	16	8	16	12	8
Drumlanrig, Dumfriesshire...	186	41.1	38.6	38.6	45.6	45.6	64.0	53.0	53.0	23.7	23.7	16.0	3.7	1.4	6.0	20	14	26	14	26	20	14	26	14	26	20	14

WEATHER TABLES FOR SCOTLAND, FROM 1856 TO 1861.

LOCALITY.	Height above sea level.	Mean tempe- rature.		Highest mean tempe- rature.		Lowest maxi- mum heat.		Highest mini- mum cold.	Greatest cold.	Average amount of rain.		Smallest amount of rain.		Average number of rainy days.		Smallest number of rainy days.		Greatest number of rainy days.		
		Dgs.	Fhs.	Dgs.	Fhs.	Dgs.	Fhs.			Dgs.	Fhs.	Inches.	Dgs.	Fhs.	Inches.	Dgs.	Fhs.	Dgs.	Fhs.	Dgs.	Fhs.
April.																				
Bressay, Shetland Islands	25	41.5	39.0	44.8	47.8	39.0	44.8	59.0	54.0	31.0	24.0	24.0	1.9	0.6	4.0	12	15	6	7	15
Sandwick Manse, Orkney Is.	94	43.2	39.1	47.6	50.4	39.1	47.6	60.0	50.4	31.7	26.8	26.8	1.8	0.3	4.3	16	18	7	8	14
House of Tongue, Sutherland	40	43.1	40.4	45.2	48.2	40.4	45.2	70.0	57.0	33.0	27.0	27.0	2.0	0.9	3.9	11	14	8	9	20
Stornoway, Lewis Island	70	42.6	40.6	45.9	48.9	40.6	45.9	61.0	53.0	33.5	26.0	26.0	1.8	0.6	3.1	12	15	8	9	24
Culloden, Inverness-shire	104	44.1	41.2	46.0	49.0	41.2	46.0	69.2	56.6	34.0	27.0	27.0	1.3	0.8	2.1	15	18	9	9	24
Perth	66	46.4	42.2	48.6	51.6	42.2	48.6	74.0	60.0	33.0	24.0	24.0	2.1	0.8	3.5	13	16	7	7	19
Lochgillhead, Argyllshire	65	43.9	41.1	47.1	50.1	41.1	47.1	67.0	60.0	32.5	24.0	24.0	2.3	0.5	3.6	12	15	7	7	16
Edinburgh, Ord. Surv. Office	307	44.6	43.1	46.3	49.3	43.1	46.3	71.4	60.2	35.7	26.5	26.5	1.2	0.4	2.1	11	14	6	6	20
Milne-Graden, Berwick	100	43.7	41.2	45.8	48.8	41.2	45.8	69.0	61.0	29.4	24.0	24.0	1.8	0.9	3.9	9	12	5	5	17
Drumlaug, Dumfriesshire	186	44.3	42.0	47.8	50.8	42.0	47.8	73.0	60.0	24.7	18.0	18.0	2.1	0.6	3.5	13	16	8	8	20
May.																				
Bressay, Shetland Islands	25	46.3	44.8	49.2	52.2	44.8	49.2	66.0	57.0	35.0	29.7	29.7	1.3	0.1	2.5	9	12	1	4	19
Sandwick Manse, Orkney Is.	94	47.8	43.8	51.4	54.4	43.8	51.4	68.7	55.5	37.8	32.2	32.2	1.6	0.4	3.5	12	15	4	7	20
House of Tongue, Sutherland	40	48.6	46.2	50.6	53.6	46.2	50.6	76.6	63.0	34.9	28.0	28.0	1.5	0.0	3.4	14	17	6	6	20
Stornoway, Lewis Island	70	48.2	46.2	50.7	53.7	46.2	50.7	67.0	58.0	37.0	32.5	32.5	2.2	0.5	4.1	12	15	7	7	25
Culloden, Inverness-shire	104	49.7	46.6	53.1	56.1	46.6	53.1	70.1	63.0	37.5	34.2	34.2	1.3	0.1	2.6	18	21	6	6	25
Perth	66	50.7	46.6	53.4	56.4	46.6	53.4	74.0	62.0	35.0	27.0	27.0	1.9	0.3	2.8	12	15	5	5	18
Lochgillhead, Argyllshire	65	50.6	48.0	52.9	55.9	48.0	52.9	82.0	65.0	42.0	30.0	30.0	3.3	0.7	4.4	17	20	4	4	18
Edinburgh, Ord. Surv. Office	307	51.5	48.5	53.1	56.1	48.5	53.1	72.2	64.6	38.8	32.0	32.0	1.3	0.0	2.6	9	12	2	2	15
Milne-Graden, Berwick	100	49.8	46.2	52.5	55.5	46.2	52.5	74.0	66.0	38.0	26.4	26.4	2.3	0.8	3.6	8	11	2	2	12
Drumlaug, Dumfriesshire	186	50.3	48.9	52.8	55.8	48.9	52.8	77.0	70.0	31.0	20.7	20.7	2.6	0.6	6.4	13	16	5	5	18
June.																				
Bressay, Shetland Islands	25	52.8	50.2	57.6	60.6	50.2	57.6	75.0	62.0	47.0	38.7	38.7	1.5	0.3	2.9	10	13	7	7	15
Sandwick Manse, Orkney Is.	94	52.8	49.2	58.0	61.0	49.2	58.0	70.5	60.3	44.8	41.0	41.0	2.1	0.6	3.0	12	15	5	5	22
House of Tongue, Sutherland	40	56.7	52.3	57.7	60.7	52.3	57.7	79.6	65.0	44.0	36.0	36.0	2.2	0.5	5.6	13	16	6	6	22
Stornoway, Lewis Island	70	53.3	51.0	54.5	57.5	51.0	54.5	73.0	60.0	42.5	34.0	34.0	3.1	1.6	6.1	14	17	6	6	22
Culloden, Inverness-shire	104	56.4	53.0	56.0	59.0	53.0	56.0	77.1	62.2	47.4	38.0	38.0	2.4	1.4	3.1	18	21	14	14	26
Perth	66	58.5	53.4	58.5	61.5	53.4	58.5	84.0	70.0	48.0	34.7	34.7	3.6	2.0	7.1	13	16	8	8	18
Lochgillhead, Argyllshire	65	57.6	51.4	60.8	63.8	51.4	60.8	77.8	60.0	46.4	39.0	39.0	3.9	2.1	6.5	15	18	11	11	25
Edinburgh, Ord. Surv. Office	307	57.5	54.4	61.3	64.3	54.4	61.3	81.0	69.0	46.3	43.0	43.0	2.5	1.6	3.6	12	15	8	8	17
Milne-Graden, Berwick	100	56.7	53.9	61.3	64.3	53.9	61.3	81.0	66.0	42.4	40.0	40.0	3.6	2.9	5.6	11	14	7	7	15
Drumlaug, Dumfriesshire	186	57.3	55.6	63.7	66.7	55.6	63.7	80.0	76.0	39.0	31.0	31.0	3.3	2.1	5.5	13	16	7	7	22

WEATHER TABLES FOR SCOTLAND, FROM 1856 TO 1861.

LOCALITY.	Height above sea level.	Mean tempe- rature.	Lowest tempe- rature.		Highest tempe- rature.		Greatest heat.	Lowest maxi- mum heat.	Highest mini- mum cold.	Greatest cold.	Average amount of rain.		Smallest amount of rain.	Greatest amount of rain.	Average number of rainy days.		Smallest number of rainy days.		Greatest number of rainy days.	
			Dgs.	Dgs.	Dgs.	Dgs.					Inches.	Inches.			Dgs.	Dgs.	Inches.	Inches.		
July.																				
{ Bressay, Shetland Islands ... Sandwick Manse, Orkney Is. House of Tongue, Sutherland ... Stornoway, Lewis Island ... Culloden, Inverness-shire ... Perth ... Lochgilphead, Argyllshire ... Edinburgh, Ord. Surv. Office ... Milne-Graden, Berwick ... Drumlaurig, Dumfriesshire ... }	25	52.7	52.0	53.9	70.0	61.0	44.0	38.0	0.9	3.9	13	9	16	13	9	16	13	9	22	16
	94	55.1	51.6	61.4	67.1	63.0	47.0	43.9	2.5	4.0	17	9	22	17	9	22	17	9	26	21
	40	55.4	53.0	56.6	72.0	68.0	44.6	38.0	3.8	6.5	19	11	23	19	11	23	19	11	26	14
	70	54.7	53.2	55.6	69.0	64.0	43.0	41.0	3.6	5.8	17	11	23	17	11	23	17	11	23	14
	104	57.5	55.8	59.2	71.3	65.5	49.6	43.0	2.6	4.2	19	14	23	19	14	23	19	14	23	14
	66	60.3	58.8	63.1	78.0	75.0	45.0	34.0	3.3	7.0	15	6	16	15	6	21	15	8	14	14
	65	57.5	55.6	59.6	79.0	68.0	50.0	41.0	2.8	3.7	13	9	16	13	9	16	13	7	14	14
	307	59.8	58.2	61.3	81.0	72.7	47.2	43.7	1.8	3.3	11	8	14	11	8	14	11	7	16	14
	100	57.9	56.8	59.0	82.0	71.0	45.0	40.0	4.1	5.1	11	7	16	11	7	16	11	7	16	14
	186	58.5	56.7	61.2	87.0	74.0	37.0	34.0	2.8	4.5	17	13	21	17	13	21	17	13	21	21
August.																				
{ Bressay, Shetland Islands ... Sandwick Manse, Orkney Is. House of Tongue, Sutherland ... Stornoway, Lewis Island ... Culloden, Inverness-shire ... Perth ... Lochgilphead, Argyllshire ... Edinburgh, Ord. Surv. Office ... Milne-Graden, Berwick ... Drumlaurig, Dumfriesshire ... }	25	54.1	52.2	56.9	69.0	64.0	47.0	38.0	0.9	4.4	10	6	17	10	6	17	10	6	25	17
	94	55.0	51.8	60.6	69.5	63.0	48.5	41.7	1.4	4.9	17	11	23	17	11	23	17	11	29	23
	40	55.8	52.9	57.7	75.0	63.0	45.0	39.0	3.1	5.8	17	8	25	17	8	25	17	8	25	18
	70	55.7	53.2	56.7	77.0	70.1	48.5	40.8	1.8	3.2	15	9	18	15	9	18	15	9	25	18
	104	58.7	56.2	63.2	84.0	73.0	49.0	34.5	3.0	5.1	13	10	18	13	10	18	13	10	24	15
	65	57.2	52.0	60.6	84.0	71.0	48.0	35.0	2.5	6.3	16	11	24	16	11	24	16	11	24	17
	307	59.6	57.9	61.1	81.9	72.0	49.0	44.2	1.8	3.1	14	11	17	14	11	17	14	11	17	15
	100	58.4	55.3	60.4	80.0	69.0	46.0	41.0	2.0	3.0	10	8	15	10	8	15	10	8	15	16
	186	59.7	57.2	60.7	89.0	77.2	37.0	32.7	4.0	6.1	16	13	22	16	13	22	16	13	22	22
	September.																			
{ Bressay, Shetland Islands ... Sandwick Manse, Orkney Is. House of Tongue, Sutherland ... Stornoway, Lewis Island ... Culloden, Inverness-shire ... Perth ... Lochgilphead, Argyllshire ... Edinburgh, Ord. Surv. Office ... Milne-Graden, Berwick ... Drumlaurig, Dumfriesshire ... }	25	51.7	49.6	53.6	66.0	59.0	43.0	39.0	1.9	4.6	16	12	26	16	12	26	16	12	24	26
	94	52.4	48.3	55.4	65.5	59.2	43.0	35.9	2.8	4.6	22	19	24	22	19	24	22	19	25	24
	40	52.7	50.2	55.6	71.0	64.0	46.0	37.6	3.6	5.6	21	18	25	21	18	25	21	18	25	25
	70	51.6	49.3	54.7	66.0	60.0	45.0	35.0	2.4	5.0	22	17	28	22	17	28	22	17	28	28
	104	53.4	51.2	56.9	68.8	62.9	48.0	40.0	2.6	5.1	18	10	25	18	10	25	18	10	25	26
	66	54.4	50.4	59.4	78.0	66.5	43.0	29.0	3.4	5.6	13	9	16	13	9	16	13	9	16	16
	65	53.0	49.3	57.7	75.0	60.0	43.0	30.0	2.2	4.7	19	13	21	19	13	21	19	13	21	15
	307	55.4	53.1	57.7	77.0	67.0	44.0	38.4	0.2	4.7	12	9	15	12	9	15	12	9	15	15
	100	55.4	50.8	56.1	71.0	65.0	43.0	33.0	3.2	5.3	11	7	14	11	7	14	11	7	14	14
	186	53.3	50.9	56.3	78.2	70.0	32.0	27.0	1.4	4.7	18	11	21	18	11	21	18	11	21	21

Climate of Ireland.—It remains now to give such a representation as is possible, in a similar way, of the climate of Ireland. In 1851, the Council of the Royal Irish Academy had meteorological observations taken in a number of selected localities, which were submitted to the Rev. H. Lloyd, who several years ago published a paper on the subject. Through the kindness of the author it has been possible to give the result of these observations, in two tables; and in order to increase their value, tables of temperature at Armagh, Dublin, and Limerick have been added. The editor is also indebted, through Mr. Lowe, to the Rev. Dr. Robinson for 17 years' observations at Armagh; and to Colonel Sir Henry James, R.E., F.R.S., Superintendent of the Ordnance Survey, for 18 years' observations made at Dublin, and for 7 years' observations at Limerick; the former under the superintendence of Lieut.-Colonel Larcom, R.E., and Captain Cameron, R.E., and the latter under Lieut.-Colonel Stotherd, R.E. These, on comparison with corresponding figures in the other tables, will sufficiently show how very different is the climate of Ireland from that of England.

Temperature.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
ARMAGH.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.
Greatest heat ...	52·8	52·7	55·6	62·7	69·1	74·4	74·8	73·1	68·5	61·9	55·7	54·0
Lowest max. ...	34·4	36·1	39·3	45·3	50·3	56·3	60·0	58·4	53·8	45·9	38·5	35·3
Lowest cold	25·4	26·2	27·2	32·4	34·3	43·6	46·5	45·6	41·2	34·2	28·8	25·2
Highest min. ...	44·3	44·4	45·5	48·8	53·0	58·4	59·6	59·7	56·4	53·7	49·3	45·4
DUBLIN.												
Highest mean ...	45·2	45·2	46·5	49·1	55·0	61·3	61·3	59·6	56·7	52·5	48·0	48·1
Lowest mean ...	36·2	36·9	37·5	39·6	47·7	53·3	55·4	54·3	51·0	45·1	40·0	36·1
Range in mean...	9·0	8·3	9·0	9·5	7·3	8·0	5·9	5·3	5·7	7·4	8·0	12·0
Average mean ...	40·5	41·1	42·3	45·5	50·8	55·5	58·2	57·2	53·8	48·7	44·5	42·8
Greatest heat ...	57·5	58·5	61·1	71·0	75·3	80·0	79·8	77·0	77·0	67·0	63·0	59·9
Lowest max.....	48·6	49·0	51·0	57·5	61·5	66·0	65·6	68·5	65·5	58·9	51·5	47·0
Phoenix Park :												
Lowest cold	13·8	12·5	21·0	28·0	27·5	38·3	40·0	38·5	32·5	27·0	24·5	20·0
Highest min. ...	30·5	33·0	33·5	38·0	45·0	49·0	51·0	52·0	45·0	43·5	35·0	33·0
LIMERICK.												
Highest mean ...	43·8	43·1	47·2	50·6	54·0	63·4	59·7	60·8	55·8	48·0	47·6	43·9
Lowest mean ...	38·2	40·1	42·3	46·0	52·1	56·5	56·1	56·9	52·2	46·9	43·4	39·6
Range in mean...	5·6	3·0	4·9	4·6	1·9	6·9	3·6	3·9	3·6	1·1	4·2	4·3
Average mean ...												
Greatest heat ...	56·0	55·0	62·0	70·0	76·5	83·0	74·5	78·5	70·0	60·0	58·5	55·0
Lowest max.....	51·5	52·0	54·0	65·0	70·0	69·5	68·5	69·0	67·5	58·0	53·0	52·5
Lowest cold	23·3	26·5	26·5	31·0	35·0	46·0	48·0	45·5	42·0	30·0	28·0	27·5
Highest min. ...	33·0	32·0	37·5	40·0	42·0	50·0	51·0	52·0	48·0	38·5	35·5	30·0

The following details have now to be supplied of the rainfall at Armagh, Dublin, and Limerick, for 20, 16, and 7 years respectively.

First, of the rainfall at Armagh from 1841 to 1860—observed by the Rev. Dr. T. R. Robinson, F.R.S., the station being 211 feet above the sea:—

RAINFALL AT ARMAGH.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total.
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Greatest amount (inches)...	7·8	6·7	4·2	5·9	3·4	5·7	4·8	5·2	3·5	5·0	7·5	8·7	49·2
Least amount	1·9	1·3	0·5	0·0	0·0	0·9	1·1	1·1	1·2	1·3	1·4	0·5	30·2
Average amount	4·0	2·7	2·4	2·7	1·9	2·8	2·9	2·9	2·5	3·2	3·1	3·5	34·8
Rainy Days :	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Greatest number	28	23	27	26	21	26	25	24	24	28	26	31	—
Average number	20	15	18	18	14	17	19	18	15	21	19	19	213

The following, again, is an account of the rainfall at the Ordnance Survey Observatory, Phoenix Park, Dublin (from 16 years' observations), from 1837 to 1852:—

RAINFALL AT DUBLIN.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Greatest amount (inches)...	4·2	4·6	2·4	5·5	4·6	6·1	6·2	4·8	6·1	4·8	5·9	3·7	38·9
Least amount	1·1	0·7	0·3	0·8	0·3	0·4	0·8	1·5	0·6	1·5	1·0	0·4	24·0
Average amount	2·4	2·0	1·5	2·1	2·2	2·3	2·8	3·0	2·3	3·0	3·1	2·3	29·1
Rainy Days :	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Greatest number	28	24	28	26	22	25	26	29	28	29	29	31	—
Least number	9	14	8	11	11	9	15	10	15	20	20	14	—
Average number	21	18	20	20	16	16	19	22	19	22	23	22	237

And, lastly, the following figures represent the rainfall at Limerick from 7 years' observations (1840 to 47), by Lieut.-Colonel Stotherd, R.E. :—

RAINFALL AT LIMERICK.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
Greatest amount	4·7	5·4	4·6	4·2	4·4	2·9	4·2	5·4	3·3	5·1	4·6	3·7	38·3
Least amount	1·4	0·7	0·2	0·9	0·2	0·6	1·8	1·3	1·7	1·0	3·4	0·9	30·9
Average amount	3·1	2·3	2·6	2·4	2·1	2·3	3·2	3·8	2·8	3·4	3·9	2·3	34·9
Rainy Days :	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Greatest number	31	27	27	25	25	25	30	29	28	29	27	30	—
Least number	20	14	8	12	2	11	18	13	12	13	18	10	—
Average number	25	20	20	18	17	17	24	22	20	23	24	22	254

The table of rainfalls in 1851, on the previous page, was kindly furnished by the Rev. Dr. Lloyd. In the instance of the return from Westport, Mayo, it should be named that the rainfall is given for only half the month during January.

THE FARMER'S CALENDAR.

JANUARY.

The ordinary weather of this month in different parts of England* will be gathered from the table given in the next page, compiled by Mr. E. J. Lowe, of Highfield House, Nottinghamshire, which states the average temperature of January for a series of years at the stations specified. The average rainfall is also given, with the ordinary number of wet days—together with the number of years at each station during which the observations thus collated have been taken.

The work of the farm during January may include the following particulars, some of which, as will be seen, are referred to under other months, when they are also appropriate, while the others are discussed in the order in which they are numbered :—(1) *Land Drainage—Road-making*, described in October—*Marling, Chalking, Liming*, referred to in the autumn months.—(2) *Preparation of Compost and Manure Heaps*, and carriage of dung to field.—(3) *Tillage operations*.—(4) The sowing of various crops as (a) *Wheat*, (b) *Oats*, (c) *Peas*, (d) *Beans*.—(5) *Management of Pasture and Meadow land*.—(6) *Threshing of Grain* for market—Livestock management, including (7) *the Feeding-house and Cow-byre*, (8) *the Sheepfold*, (9) *the Pig-sty*, (10) *the Stable*, (11) *Management of Fences* and of (12) *Woodland*.

I.—LAND DRAINAGE.

This operation, proper for any month of the year when the land is not in crop, and especially proper for any winter month (when the ground is soft, and when standing water shows the levels and indicates the fall), is only mentioned incidentally in the last edition of the *Farmer's Calendar*. It is now universally considered to be the very foundation of good farming, and our first pages are therefore devoted to a consideration of the means, methods, and results of it.

* Similar tables of Scottish and Irish climates will be found in the Introduction to this work.

THE WEATHER OF JANUARY.

LOCALITY.	AUTHORITY.	Mean tempe- rature.	Lowest mean tempe- rature.	Highest mean tempe- rature.	Greatest heat.	Lowest maxi- mum heat.	Highest mini- mum cold.	Greatest cold.	Average amount of rain. inches.	Smallest amount of rain. inches.	Greatest amount of rain. inches.	Average number of rainy days.	Smallest number of rainy days.	Greatest number of rainy days.	No. of years observed.
Guernsey.....	Dr. Hoskins, F.R.S.	43.6	39.6	46.8	55.0	51.0	37.0	27.0	3.8	1.0	6.6	18	9	26	13
Helston.....	Mr. M. P. Moyle...	44.2	39.6	47.8	60.0	50.7	34.0	23.0	4.0	0.7	6.9	20	8	30	13
Exeter.....	Mr. W. H. Ellis....	41.3	35.6	46.0	61.0	52.5	31.8	19.0	2.6	0.1	4.9	18	1	30	13
Ventnor, Isle of Wight.....	Dr. Martin.....	42.4	38.7	45.6	55.0	50.0	32.0	24.0	2.6	0.3	3.7	16	9	22	9
Worthing, Sussex	Dr. Barker.....	40.1	36.5	43.8	52.0	48.8	33.8	20.0	2.2	0.2	4.6	16	6	21	8
Clifton near Bristol	Mr. W. C. Burder...	39.2	36.2	41.5	56.0	51.3	27.2	15.0	2.6	0.3	4.9	20	12	26	8
London Royal Observatory..	{ The Astronomer { Royal.....	38.4	33.8	42.9	56.5	50.4	30.8	13.5	1.8	0.7	3.6	15	5	21	14
Oxford.....	Rev. R. Main, F.R.S.	38.6	29.2	42.9	56.6	42.4	29.5	7.5	1.1	0.3	1.8	9	6	15	12
Bedford.....	Dr. Barker.....	39.7	30.0	41.6	58.0	43.0	31.0	12.0	1.8	0.2	3.5	15	9	21	10
Lampeter, near Cardigan.....	Professor Matthews	39.1	36.0	41.3	55.0	49.8	23.0	14.1	3.7	0.6	6.6	17	14	22	6
Norwich.....	Mr. W. Brake.....	37.0	30.0	41.6	58.0	43.0	32.0	6.0	1.9	0.4	3.6	14	6	21	13
Highfield-House Observatory..	Mr. E. J. Lowe....	36.5	26.7	45.1	56.1	46.5	29.5	-4.0	2.1	0.2	3.7	17	6	27	14*
Hawarden, Chester	Dr. Moffat.....	39.3	33.1	42.8	56.5	50.0	31.0	13.0	2.0	0.3	3.7	13	5	23	11
Manchester.....	Mr. G. V. Vernon	38.3	34.4	41.4	57.0	51.4	28.0	3.5	2.7	0.8	4.7	18	11	24	11
Leeds.....	Mr. H. Denny.....	39.8	37.9	42.7	58.0	50.0	29.0	14.0	2.6	0.7	5.3	16	9	21	9
York.....	Mr. Ford.....	36.5	32.1	40.5	55.5	47.0	28.5	-3.0	1.8	0.5	2.6	13	4	22	13
Scarborough.....	Mr. B. Cooke.....	38.6	37.1	41.6	57.0	48.5	29.5	22.0	1.3	0.9	1.6	11	5	18	6
Isle of Man.....	Mr. J. Burman.....	41.0	38.5	43.7	52.5	50.0	31.0	19.8	2.5	0.3	6.2	16	8	24	6
Durham.....	Mr. A. Marth.....	36.6	32.4	42.6	55.0	45.4	29.4	3.8	1.9	0.6	4.4	14	8	23	9
North Shields.....	Mr. R. Spence.....	38.3	36.2	41.7	55.0	46.8	29.0	14.0	3.1	0.6	6.7	19	6	27	10
Silloth.....	Rev. T. Bedford....	38.6	37.1	41.9	53.2	49.3	25.6	18.8	2.9	0.3	5.8	—	—	—	6

* Observations at Highfield House on temperature extend over fifty years.

Means of Land Drainage.—Its cost, of course, is borne by the owner of the land; for he either supplies the means directly, and charges an additional rent for their repayment to him, or he takes a smaller rent for a term of years in consideration of the expenditure being undertaken by the tenant. The former is the better course for him, as he is thus enabled to superintend the operation, and carry it out on a consistent plan over his whole estate, by which alone it can be conducted efficiently and economically. And it is not necessary to this end that the landlord be personally a wealthy man. The 4,000,000*l.* placed by the Land Drainage Act (1846) at the disposal of commissioners for his assistance, have indeed been all long since bespoken—1,000 applicants in England having taken 1,780,000*l.*, 900 applicants in Scotland having taken 2,200,000*l.*, and fifty applicants in Wales having taken 100,000*l.*; but other means exist by which owners with merely a life interest in their land, may borrow money to be expended in its improvement, charging the cost of this improvement on the property itself—a rent-charge being taken on the estate for the repayment of the sums advanced. These means are the Private Moneys Drainage Act (12 & 13 Vict. cap. c.), which provides for land draining only, requiring an annual rent-charge for twenty-two years of 7*l.* 5*s.* for every 100*l.* expended; the West of England and South Wales Land Draining Company* (11 & 12 Vict. cap. cxlviii.), which has power to drain, irrigate, enclose, make roads, farm buildings, &c., charging all the cost upon the estate, thus creating a rent-charge, either perpetual or redeemable at any time; the General Land Drainage and Improvement Company† (12 & 13 Vict. cap. cliv.), which takes for various terms, from twenty-two up to fifty years, for every 100*l.* spent in the same way, a rent-charge, varying in amount from 7*l.* 10*s.* to 5*l.* per annum, according to the period over which it is to last, and according to the amount to be invested; and lastly, there is the Land Improvement Company, whose powers extend to Scotland, requiring a rent-charge on the land for twenty-five years of 6*l.* 10*s.*, or 7*l.* per cent., according to the state of the money market.‡ There can, therefore, be no excuse, on the score of poverty, for the miserable condition in which much land in this country still lies for want of drainage, roads, and buildings.

And even if the landlord will not charge his estate for its permanent improvement in this way, yet the tenant with a lease for twenty-one or nineteen years, or an even shorter term, will be well repaid for doing it himself. Of course a tenant farmer, with a certain amount of capital at his disposal, seeks the best investment for it which he can obtain. It is his interest rather to take a farm

* Messrs. Bidwell and Brodie, Exeter, Secretaries.

† W. Clifford, Esq., 52, Parliament Street, Westminster, Secretary.

‡ Hon. W. Napier, Managing Director, 2, Old Palace Yard, Westminster.

in perfect order, and pay a corresponding rent; but supposing him to have taken land requiring drainage, which yet the landlord will not drain, then unquestionably the tenant himself, if he possess the means, cannot more profitably employ them than in draining the land he cultivates. It is not, indeed, to be expected of him that he should conduct the operation so that it shall outlive his interest in the land; but practically it is found that land drained so as to retain the improvement for twenty years is permanently improved, and that, on the other hand, a substantial and permanent land drainage will alone remain in successful operation for so long as twenty years.

Methods of Land Drainage.—Let us suppose a case. Your farm is partly clay and partly sand. In certain portions, too, it lies upon a porous subsoil, furnishing the best possible natural drainage of the land. The fields are of irregular form, divided in some cases by wide and straggling hedgerows containing trees. There is a brook running down the middle of the farm, its tortuous course is fringed by alder, hazel, thorn, and willow, and the surface drainage into this brook is effected by means of ditches—around, and sometimes through, the fields—which are as much old and permanent water-courses as is the brook itself. Here and there these ditches receive, not merely the flood water of a rainy time flowing over the surface of the land, or that which slowly oozes into them from below the surface of the land, but spring water also, especially from along the line which separates the higher sandy land from the beds of clay which crop out in the lower part of the farm, producing the clay soils of the lower fields. This, then, is your farm, including almost all the difficulties that drainers have to encounter—a sluggish outfall, much spring water, irregular enclosures, various soil, hedgerow timber.

The first advice you need is, that your plan be formed so as to embrace the whole of your occupation, and that you do not fritter away your means in laying one field after another dry, on plans proper perhaps to each, but inconsistent with each other. This is especially good advice when a whole estate, comprising several farms, is taken in hand for improvement. You have then (1) to determine on one or more outfalls, and fit them for their purpose; (2) to effect the removal of spring water, mischievous in more than its immediate locality; and (3) to arrange the order in which the general work shall be done, which depends on two considerations—viz., (*a*) the need of working from the outfall upwards, and (*b*) the possibility that water removed from one part may lay dry another—so that here, as opposed to the first consideration, the propriety may sometimes be indicated of draining a higher field first of water which is thus hindered from reappearing below.

This possibility may sometimes be foreseen by a geological ex-

amination of the land ; but it is only fair to say that it is not of ordinary occurrence. I believe that in the drainage of the Hinxworth estate (Herts), where the fields had been drained consecutively, commencing with the lowest, the main drain of one of these lower fields which ran copiously for some weeks after execution, was laid almost dry by a few drains conducted afterwards into two or three higher fields above it, which had the effect of tapping, as it were, a porous subsoil full of water, whose only exit had been through the land into the field below them. This, however, obviously came under the class of spring drainage. Large reservoirs of water making an escape with difficulty at the point of least resistance, are at once the cause and explanation of springs : and these reservoirs need to be tapped, and thus provided with an easy exit for their contents altogether independently of that which is the ordinary object of the land drainer—viz., the removal of the rain-water, after percolation through the soil and subsoil of the spot on which it falls.

As a general rule, then, you commence with the lowest fields, and the outfalls of your farm need first to be chosen and prepared. More than one may be made necessary by the configuration of the land. On the Hertfordshire estate, already named, lying upon the lower Chalk, the Gault, and Green-sand formation, no fewer than twenty-two outfalls had to be provided on seven hundred acres, from every one of which the open ditch or natural water-course led away in different directions. The outfalls themselves were bricked outlets, furnished with an iron gutter and hinged grating, permitting easy exit and facilities for clearing, forbidding entrance to anything, and insuring permanent efficiency at the point on which the efficiency of the whole process depends.

The drawings on page 5 represent one of these outfalls as made under the direction of Mr. Bailey Denton, C.E.

But in the case supposed your farm lies in a valley, and a brook runs through the middle of it—a single final outfall or one on either side at the lowest point of the water-course, may thus alone be needed. Your first step is to improve the water-course ; its outfall must be perfected, its tortuous course must be straightened, so far as this can be done without excessive outlay ; for, independently of its serving the purpose of a channel for the water which your drains may pour into it, its ability to remove what water comes into it at its upper end when it first enters the farm, is a point of great importance for the success of your drainage operations. Let this, indeed, be your first object, to remove what water comes on your land otherwise than directly from the clouds. To this end you straighten your brook, that its water may pass through unchecked, and to this end you lay drains to take the water from all springs. An examination of the fields where they occur will lead you to select

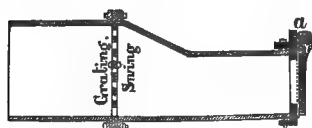


Fig. 1 is a longitudinal section of the outlet pipe, with a hanging flap (a) to prevent the influx of tidal or flood-water; the hinged grating is also shown, the pipe being there of larger size to compensate for that portion of its capacity which is taken from it by the bars of the grating.

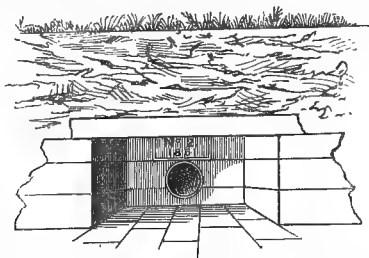


Fig. 2 gives a front elevation of the smaller outlets in which this pipe is used.

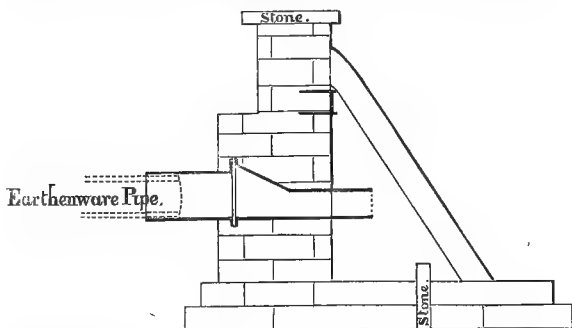


Fig. 3 gives a section of the larger outlet where the egress of a large body of water is provided for; and substantial mason work is erected for the maintenance of the place.

the spot from which a conduit directly to the brook will lay a number of them dry, and apparently effect the drainage of a large tract which may have been flooded by them.*

Of Spring Drainage the following account may suffice. Books on drainage furnish you with illustrations of the way in which a large extent may be rendered marshy by a cause operating more especially at one point, for which, as the seat of the drain, the experienced drainer looks, and whence he conducts his conduit. It was thus that Elkington and others after him showed their tact and skill. His object was to lead off the water which either oozed upwards at the point of least resistance, under pressure from a porous stratum holding it imperfectly in confinement above, or which flowed

* See Mr. J. Girdwood's Article in the "Cyclopædia of Agriculture." Blackie.

over the lowest lip of the impervious basin which retained it. And so he endeavoured to place his conduit exactly at the point of least resistance—really at the lowest lip; in the discovery of which, where all is covered with soil, considerable experience and skill are needed. He distinguished between what he called false springs and true springs—the former appearing only in flood times, indicating a fuller basin or a greater pressure than usual—so that the ordinary exit being insufficient, escape was made at other points not of the least resistance, not on the lowest lip. His object, of course, was to find the point of least resistance and the lowest lip; and, improving the means of exit there, to increase the opportunities for escape, so that any quantity of water that might offer should flow off unrestrictedly. He thus hindered the possibility of these false springs making their appearance under ever so great an abundance of rain.

It is proper to add, that the figures given in books, however satisfactorily they explain the theory of spring drainage, do not really furnish much assistance to one who comes with his book into the field, there to apply his knowledge for the first time. He sees a swamp lying, it may be, on the side of a sloping field, or perhaps a number of such swamps, and there is the possibility of the water in an upper one being the identical stream which reappears below, so that a drain from the upper swamp would dry the lower one. But there is also the possibility of the upper swamps being only “false springs,” the lower swamp being the “true” one delivering, in ordinary seasons, all the water offering; which in a wet season, owing to the insufficiency of this exit, rises, and appears at higher places too. In that case, on the other hand, a drain from the lower spot would dry the upper ones. Then, again, it is often the case that a swamp lies along the whole side of the hill, and the “book farmer”—shall I call him?—is puzzled to know whether he is, as some authorities tell him, to cut a drain across the slope above it, and so, according to one theory of the appearance, intercept the water on its downward course, before it has left the bed of clay to which the out-crop of this sideland swamp is attributed; or, as others have it, cut a conduit upwards boldly through the middle of the mischief, and note its effect, in the first place, upon the whole extent of surface damaged. And this, indeed, is generally the best course to pursue. Such a conduit, if there be uncertainty as to its effect, need be nothing more than one of the parallel drains of the ordinary system of drainage, whose purpose it will serve, if it should fail of any other. But an examination by trial holes, or even by the auger, will generally discover the point from which the most abundant flow of water may be expected; and then a conduit, made of pipes large enough for the largest expected stream, and deep enough to insure its final burial, should at once be laid from it to the nearest outfall.

When, by a straightened brook and well-placed conduits from the swamps and springs, all the water is enabled to flow off unchecked which appears upon your farm otherwise than directly from the clouds, then you have to deal with the rain-water (the great natural fertilizer of your land) in the manner which shall insure the full use of it; and this can be attained only by enabling its passage by gradual percolation downwards through the soil and sub-soil.

Relation of Drainage to Fertility.—If rain water has no escape through the soil, then it first stagnates in and on the land, and afterwards flows over it or dries off it. By stagnation, water hinders a variety of chemical processes within the soil, which are dependent on the presence there of air; by flowing over the surface of the land it carries away the finer particles of soil and the manure laid on it; and by evaporating from its surface, it cools the surface of the land. But it is on these three particulars—the warmth of the soil, the soluble ingredients of the manure, and the chemical action within the soil of air and of water holding it in solution—that fertility depends; and thus it is that land through which the rain-fall does not percolate is injured by it. If, on the other hand, the rain-fall is enabled thus to percolate, then (1) it carries downwards with it, and drags downwards after it the air, which is so necessary an agent within the soil in the preparation of the food of plants; and (2) instead of flowing over the soil, and carrying its fertilizing ingredients to waste, its contents taken from the air which it has traversed are added to the warehouse of the soil, and a direct addition is thus made to the food of plants within it; and (3) instead of cooling the soil by evaporation, it carries, during spring time, the warmth of returning summer to the roots of plants, whose vitality and consequent energy of growth are thus excited. And besides all these particulars, in which the influence of moving water within the soil is contrasted with that of stagnant water there, you must remember that one great use of water in the land is to dissolve out the soluble ingredients of the soil, and carry them by the roots of plants, which may thus be fed; and no such use can be expected of it while it is stagnant. Its continual percolation through the land is therefore needed, not only as introducing chemicals which, as in a laboratory, prepare the food of plants—not only as introducing useful ingredients to the store-room of the food of plants, and not only as improving the underground climate on which early spring and rapid growth depend—but also as facilitating the movement of feeding matters within the soil, and so introducing activity into the feeding process; in other words, facilitating growth.

How, then, are you to induce this percolation downwards of the rain-water through the soil? Observe the process in those portions of your farm where it naturally obtains. It was thus that the late

James Smith, of Deanston, came to adopt and advocate the so-called frequent-drain system. If, in addition to his copying nature by providing under the whole surface of the land a multitude of exit channels, so that, as towards fissures in the subjacent rock, the water should sink where it fell, and find its escape outwards through the subsoil, he had also imitated her in her best examples where fertility is seen on deep soils over a porous subsoil, and so placed his exit channels at a depth which would have needed for their operation a passage of the rain-water through a greater thickness of the soil than in the Deanston system was required, that system would then have never been disturbed. Mr. Smith's plans, however, were perfected only when to drainage was added subsoil ploughing. His theory was, that the rain dropped to the depth of the deep tillage, where it fell, and then flowed along the subsoil, as along a floor, to the drains; and these were trenches filled with broken stones nearly to the level of the subsoil ploughing. But this would be a very imperfect result of land drainage. The perfectly drained soil and perfectly cultivated farm does, indeed, more and more ignore the distinction of soil and subsoil.

On the proper depth of Drains.—Under perfect tillage, the object aimed at is to obtain a much greater depth of useful feeding-ground for plants than is provided by mere tillage implements. There are substances much below the reach of plough or cultivation on which plants feed, and for which their roots will go; and the subsoil (if so it must be called) will be more and more improved as a store-room of food for plants by any means which shall insure the percolation of rain-water through it: and this can be effected only by deep drains. Even in the case of clayey soils there cannot be a question of the fact, that drains four feet deep are admirably efficient, wherever ordinary pains are taken to break up the soil by cultivation when it is dry. Let it be remembered, that the sole operating cause in land drainage is the weight of the water, and there will be the less astonishment that the deeper drain will be more efficient than the shallow one. There is, in fact, in the former case, a greater weight of water pressing its way out of the exit hole.

The cost of the process is quite enough to hinder your going unnecessarily deep. And, supposing that the outfall permits us to lay our drain at what depth we choose, the only question that need arise is—What is the depth which the interests of fertility require? And there need be no hesitation in saying, that the general experience of agriculturists as to land drained from two to three feet, and from three to four feet deep respectively, has proved the superiority of the greater depth. Our tillage operations would some of them interfere with drains laid so shallow as the smallest depth here named, and indeed, except perhaps in pasture lands—and there they are not justifiable—we never hear now of drains laid so near the

surface as twenty-four or thirty inches. The roots of plants would use a greater depth if it were accessible.

You would indeed do well to think of the mass of earth through which you can get rain-water to percolate, not as so many inches deep of soil, but as so many tons weight or cubic yards of material, which by cultivation and rain-water you have to fertilize, and from which by rain-water and by living plants you have to extract and convert the fertility you have conferred. No doubt the principal limit put to the depth of drains is the cost of this depth; for the greater depth of deeper drainage does not justify us in materially diminishing their frequency and so shortening their length per acre. But admitting the greater cost of the deeper drains, and supposing that drainage 2, and 3, and 4 feet deep will cost 3*l.*, and 4*l.*, and 5*l.* respectively per acre, yet we must remember that the mass of soil actually drained by these several operations, supposing the average depth so drained to be 18, 30, and 42 inches deep respectively, amounts to 65,000, 109,000, and 152,000 cubic feet respectively per acre; and the mass of soil which is thus placed so as that rain shall percolate through it, amounts to probably at least 3000, 5000, and 7000 tons in the several cases; thus costing 1*l.* for about 1000 tons of earth in the cheaper shallow drainage, and 1*l.* for 140 tons of earth in the last case, which, though dearer per acre, is thus shown to be cheaper per the weight of earth laid open by it as the feeding ground of plants. Looking upon drainage, therefore, as the means of rendering fertile not so much a surface as a *mass* of soil, it is plain that the deeper and more costly drainage per acre may be the cheaper of the two.

But this question of depth is to some extent determined by the force of capillary attraction within the soil; for, in order to lay a certain depth of soil so free from water as that rain, when falling on it, shall at once travel through it downwards, it is plain that the whole mass of soil of that depth which it is thus desired to lay dry, must be considerably raised above the level at which water can *stand* within the subsoil.

At a meeting of the London Farmers' Club some years ago, a gentleman who farms largely in Hampshire declared with energy that, give him but twenty inches downwards of dry soil, and he cared not though the waters of the Hellespont ran beneath it. He thought that his experience thus gave a complete answer to the arguments for the deeper drainage that was being advocated: he forgot this property of the soil to which I am alluding. It is because we cannot have twenty inches of dry soil over standing water, that we contend for the deep drains by which the water level is put low enough to insure sufficient depth through which rain-water shall percolate with facility. Of course, the water in the hard stiff clays of which some subsoils consist, cannot be considered in the

same light as a body of free water would be ; nevertheless, it remains true that, though by drains cut four feet deep in such clays, we should draw off water from them at that level, the earth above that level would remain wet up to such a height as capillary attraction lifts it ; and it is only above the level to which it is thus lifted that the land can be said to be dry. It can be said to be all DRAINED, because every addition by rain to the water in the soil, adding to the height of that water level which is due to capillary attraction, forces a corresponding quantity out below until the original level is regained, so that circulation of the water is thus effected notwithstanding that the earth is wet ; and this movement or circulation, as we have seen, is one of the chief objects of drainage.

Now, the force of capillary attraction within a soil is greater in finely divided clay soils than in coarse sands : the former soils will therefore lift water to a higher level in them than in the latter : our twenty or thirty inches of free soil must, in the former case, therefore be placed higher above the drains than in the latter, and the apparent paradox results that the stiffer the soil the deeper the drains ought to be. You need to cut a deeper pit into a saturated clay than into a saturated sand before water will begin to ooze out, and it is upon this oozing out that the whole of that circulation of water within the soil which drainage has to effect depends.

Any one who has read on the subject of land drainage, has had his attention directed to an extension of the network of cracks and fissures throughout the subsoil consequent upon the drainage of the land, by means of which it is supposed that the action of deep conduits in the drainage of stiff clays is effected. I believe that this idea does not rest on observation, but has been invented to explain the undoubted action of deep drains in clays to those who might otherwise continue sceptics : and the speculation is, probably, a mistake. If water found its way through cracks and fissures to the drains, it would have comparatively little fertilizing influence. What we want is, that the water passing through our soil shall wrap round every particle, and not wash merely the sides of cracks and fissures in its passage. These fissures have not been seen, they have been merely fancied ; but water has been *seen* oozing from a surface at every pore. And that clays are porous is proved by the fact that they are wet : whenever we shall find on digging downwards that the subsoil which we reach contains no water, then we may admit that it is needless trying to drain the water from it ; but so long as it is seen that water has gone through it into it without the aid of those cracks which drains are supposed to make, so long must it be admitted that, without the aid of those cracks, it will pass through it out of it.

These remarks upon capillary attraction are general enough. There are no definite figures expressive of the actual quantity, so

to speak, of the capillary power existing in different soils, and of the depth at which a conduit must be therefore laid in each before the water will begin to leave its surface; that is, before the weight of the column of water in question will be high enough and heavy enough to force the capillary attraction which sustains it; but it is plain that where this capillary attraction is strongest, as in clays, there this column will have to be highest; and drains, therefore, should, according to this explanation of the matter, there be made the deepest. In practice of course we make drains as deep in sands as in clays; the result being that we have a greater depth of drained soil in the former than in the latter.* My object in urging the obvious relationship of capillary attraction within the soil to the movements of the water within it, is not to induce any one in his practice to go deeper than is found actually to yield a satisfactory result: it is to give confidence in the success of deep drainage in the case of clays, of which many instances can be quoted, as being not merely exceptions calculated to excite surprise, but as being the necessary consequence of a general rule operating everywhere.

But beside the depth of our conduits, their frequency, their position, and their direction have to be determined.

The frequency of drains ought to depend not so much upon the

* It appears to me that the only reasonable argument for the shallower draining of a stiff clay soil arises out of its greater richness in matters which the plant requires as food. There is no doubt that plants will make use of a very great depth of soil and subsoil if it be laid open to them; but, on the other hand, it is plain that a smaller depth of clay soil, with its larger quantity of internal surface, owing to the smallness of its particles, and its richer composition, too, will contain as much available food for plants as a much greater depth of sandy soil. It thus amounts to this—that the maximum of depth which it is desirable, as a supply of food, to lay open to plants, is smaller in clays than in sands, while the minimum depth—that at which drains must be laid, if the capillary attraction of the soil for water is to be overcome at all—is greater in clays than in sands. The capillary attraction of the clayey soils is greatest—it is in them that water will be lifted highest from the level of the drains, and it is in them, therefore, that the drains must be laid lowest before any drainage at all is effected by them.

What this least depth at which a drain must be laid before it will act either in clay or sand may be, I do not know. We hear of trenches cut four feet deep and their sides commencing to weep at eighteen inches and two feet from the surface, and we hear of trenches cut in clay, and remaining dry and perfectly without water, though the soil is evidently injured by excess of it. I heard the other day of the drainage of a farm upon the London clay; the trenches, four feet deep, and twenty feet apart, had remained as dry as the day they were cut, notwithstanding that the soil was puddled with the rain. I do not, however, in the least fear for the result of that drainage; it is to the puddled state of the soil and the hardened condition of the land at a certain depth by constant cultivation to that depth that the impenetrable character of the subsoil is due. Let the whole surface soil be well turned over, the pan beneath broken up, and rightly cultivated, and I do not fear this turning out an exception to the rule which has proved true in so many other cases—that four-foot drains in stiff clay soils will answer perfectly when placed sufficiently near to one another.

quantity of rain-water which they have to remove (because that should be met rather by increasing their capacity than their frequency), but by the degree of facility given to its passage by the porosity or the stiffness of the soil and subsoil. On very stiff land they should be nearer to one another than on lighter soil. In the former, the passage of the water is necessarily slow, and it should not have far to travel to an outlet, or the land will remain sodden for an injuriously long time; and so in the case of wide intervals, the middle of those intervals remains unbenefited.

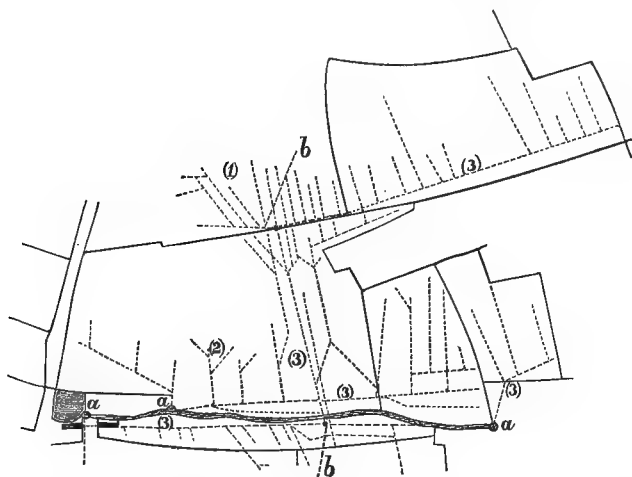
Lord Fortescue describes this evil as existing on some clay lands of his own in Devonshire, where narrow strips of good mangolds and of carrots, with intervals of dead or stunted plants, marked out the position of the drains, and of the intervals between them. These intervals, accordingly, it has been found by experience should not be more than eight yards in clay land, nor less than ten or twelve yards in lands of ordinary porosity.

On the arrangement of the drains upon the land, it would seem plain that, as we have already provided for the exit of spring water, and as our object now is merely to remove from below the soil the water which falls upon its surface, the channels for that purpose should be placed as uniformly below as the water to be removed is supplied above. And this, as a general rule, does accordingly guide the practice of the drainer. Nevertheless, the structure of the subsoil does to some extent justify a departure from that uniform arrangement of drains which would at first seem to be justified by the uniform abundance of the rain-water supplied, and by the uniform luxuriance of vegetation desired. There is a propriety in placing drains at varying intervals within the soil so as to meet those variations in the quantity of water accumulated there which have arisen from a varying structure, and even, I may add, a varying surface, of the land, notwithstanding the uniform supply of rain-water on its surface. Take a single field and you often find that it is not altogether of uniform consistency to any considerable depth. No doubt the portion acted on by tillage (the soil) is very different in its consistency from the subsoil, but this is a uniform want of uniformity. Go deeper and you will find the subsoil, which also must be drained, varying in its consistency. It may be a sand or gravel of varying depth, lying on a floor of clay, which has been water-worn and furrowed before this gravelly subsoil was brought upon it, or it may be itself a clay with porous partings or rocky beds here and there within it. All these things influence the passage of the water downwards; so that, while in a soil and subsoil of perfect uniformity, it is plain that the absorbent points on which we depend for insuring the percolation of the rain-water downwards ought to be perfectly equidistant, in an unequally constructed soil these absorbent points (or the drains which

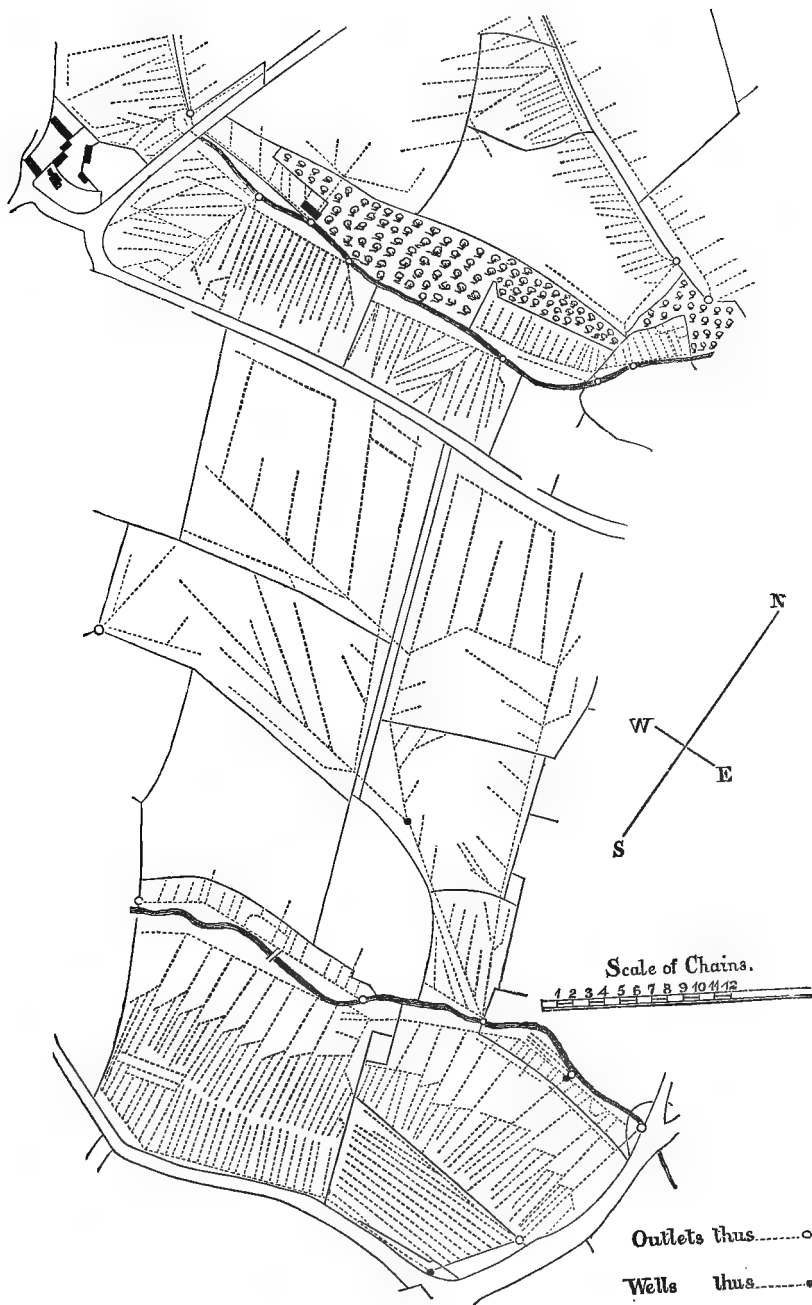
represent them) should be more frequent where the water naturally tends, than where, after a shower, less of it will be found. Of course as the object and the result of perfect cultivation is to bring about a uniform consistency to a greater depth than naturally exists, we ought not to accommodate our practice slavishly to the conditions which have arisen out of, or have been effected by, imperfect cultivation. Still, in striving after a uniform result we must not in practice put out of sight the obstacles to that uniformity which nature interposes. And I shall refer, in the sequel, to the practical methods by which these deviations from uniformity have been justified by experience on the estate of Lord Berners in Northamptonshire, and elsewhere.

In Fig. 4 there is the plan of the drains in one or two fields on an estate, a larger portion of which is represented in Fig. 5. Here

Fig. 4.



we have (1) parallel drains down the fall of the land; (2) drains for the removal of water from springs and from flats or lateral ditches or furrows in the general slope; and (3) main drains uniting at wells (*b*), and delivering their water at final outfalls (*a*). In this figure the regular drainage of a homogeneous clay upon the gridiron system is hardly represented. In the map, however, on the opposite page (Fig. 5), in which the position of the drains on an estate on the Oolitic formation, drained under Mr. Bailey Denton's directions, is given in detail, the uniform parallel drains on the more level fields upon the Oxford clay are fully represented at the foot of the map. The occasional drains, intended for the removal of spring water, and the lateral drains rendered necessary by the configuration



of the land, and intended for the removal of water lodging in slacks upon the surface, are also recognisable in some of the middle fields. There, too, and elsewhere, the less frequent generally parallel drains needed for the tapping of the more porous water-bearing strata are to be observed. Too great a stress cannot be laid on the necessity of such a plan of executed drainage—of course on a larger scale than is adopted in Fig. 5—being preserved. There are many instances in proof of this, where large sums of money have been lost entirely for want of a record of the operation. The tenants have changed, and the outfalls have been ruined and have disappeared.

On the direction of drains in land it is sufficient to say that they should go right down the hill to the main drain or the brook.

The simplest justification of this rule appears to be that, when once water has got into a drain, its uses to the soil are completed, and the object then is to let it run away as fast as possible. So far as furnishing a place for the lodgment of the water after passing through the land is concerned, every point in the drainage pipe may be considered as an independent space for its reception, and the object is that each of these spaces shall have the quickest possible exit provided for its contents as fast as they arrive.

If we could have these separate absorbent points scattered equidistantly underneath the soil—say one in every two yards square—with a direct and rapid outfall for each, then the best result would be attained, but at an excessive cost; and the question practically is whether it be better to connect these absorbent points by a conduit common to a number, lying in such a direction as that the water contributed by each shall leave it slowly, or in such a direction as that the water contributed by each shall leave it quickly. It is plain that the latter is the better method of the two, and that for this purpose those points lying immediately above one another on the slope should be connected by a conduit, rather than those points which lie obliquely on the slope. The only limit in practice to this rule is when the slope is so great that the flow of water down it would tear up the soil. So that the rule may be expressed thus:—Drains should be so directed that they shall furnish the most rapid exit for their water, under that velocity at which its passage would be attended with this mischievous effect. This seems so plain that the only explanation possible of the idea that drains aslant the slope are best is, that it originated when the object of drainage was supposed to be the removal of the water from the surface, down which it might flow until it met a catch drain which would remove it.

I have thus referred to the provision of an outfall, to the removal of spring water, and to the depth, frequency, arrangement, and direction of drains. It remains to describe the actual details by which these rules are to be carried out upon your farm. And, not-

withstanding the variety of circumstances which obtain in different fields, and different soils, or under different climates; and notwithstanding that different practice has arisen out of these varying circumstances, yet general rules may be acted on and trusted.

Influence of circumstances on the practice of the Land Drainage.—Take any two cases of soil and climate as different as this island furnishes, and yet it must be admitted that the particulars in which these cases resemble one another are much more important and influential than those in which they differ from each other. They may be respectively clay and sand, pasture and arable, with an annual fall of rain respectively of twenty-five and fifty inches—but in both cases you have a living plant capable of sending its roots some four or five feet downwards and around it—a stationary plant, nevertheless, whose food must be brought to it if it is to grow—a plant incapable of absorbing anything by the roots but things soluble, and probably indeed *dissolved* in water. In both cases you have a porous soil—there are no such things as non-porous clays, as they have been called. Experiment has proved that 100 lbs. of a dry sand in a bag will take up and hold 25 lbs. of water before it begins to drip—that 100 lbs. of loam will in like manner take up about 40 lbs. of water, and that 100 lbs. of pure dry clay will take up 70 lbs. of water in the same way. *That* shows whether soils become more or less porous as they become stiffer and more clayey. In both cases then you have a porous soil—a soil which in virtue of this porosity holds water—a soil containing matter soluble in water; and which in virtue of the quantity of internal surface, so to speak, which its porosity confers upon it, possesses, in proportion to the fineness of its particles and the smallness of its pores, an increasing power of attraction and retention over the water which it holds. In both cases you have rain-water traversing the air and dissolving soluble matter out of it, acquiring thereby greater powers of dissolving what is soluble in the soil—falling evenly upon the land, and lodging on and under the surface of it—carrying air and other substances into the soil and through it—capable also of evaporating from the soil and so producing cold—capable, in virtue of its fluidity, of running through the soil or over it. In all these particulars all soils in all cases resemble one another. Their differences are differences of degree, not differences of kind. And the rules of practice which the land drainer finds efficient under one set of circumstances prove very generally efficient under others. Nevertheless, there is hardly a speaker on the subject at agricultural meetings now-a-days who does not think it incumbent upon him to insist upon the propriety of adapting his practice to the circumstances of his case. Some soils are clays and uniform to a great depth, others are a patchwork of clays and sands and full of springs—others are laid upon a subsoil built of alternate layers of rock and earth—what an absurdity, he justly says, to lay

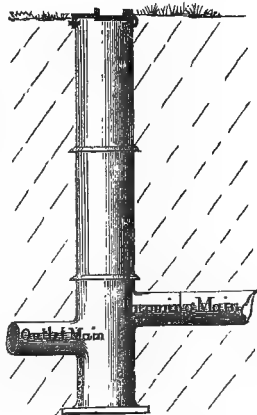
down artificial rules which shall apply uniformly over tracts of country where uniformity is not the natural rule. Of course there is a certain truth in this, and the gridiron plan, as it is in derision termed, consisting of parallel drains at regular intervals and uniform depth, is not universally applicable; nevertheless, the cry against this uniformity is now extravagant; and I have never yet seen the drainage plans of a skilful drainage engineer—the map on which his work has been laid down—that did not, after all his outcry against gridiron uniformity of parallel lines, represent in many, at all events, of the fields of the estate, the pattern of just as good a gridiron as any man might wish to see. His practical good sense had, notwithstanding his outcry against theoretical uniformity, led him to adopt parallelism of drains at intervals of greater or less distance according to the natural facility of the soil for permitting the passage of water through it. And we must not forget one tolerably uniform feature in the natural conditions of the case—viz., the fall of rain-water on the several fields of an estate. That is tolerably uniform notwithstanding the want of uniformity in the soil on which it falls, and the subsoil through which you desire that it shall pass. And after we have provided for the removal of all spring water, or other natural lodgments of it, it is, we believe, our safest plan to cut a tolerably uniform system of drains for the removal of the rain-water.

Direction of the Work.—It is safe, before the general work begins, to place drains in all old watercourses. Where old ditches have to be filled up and old hedgerows levelled, and a new division of the surface is to be adopted, it is well before laying down your "gridiron" of parallel lines for drains up and down the slope, to place lines of drain tiles in all the old ditches, providing for them outlets into the brook. Water has long found egress by those ditches, and it will continue to find its way thither, and an exit should be provided for it. Drains should also be laid in all lateral slacks, as they may be termed (nature's furrows), towards which water has been in the habit of tending, and where it has been in the habit of lodging. When this has been done, and when all subsequent levelling operations are completed, you are prepared to commence operations on all that portion of your land from which the water does not readily sink away by natural drainage.

Having prepared the outfall of the brook and straightened its course, you may conduct all the drainage of the farm into it at one main point on either side before it leaves the farm, and then your main must be large enough to take all the water falling on each half of the farm; or you may deliver the water of successive sections of the farm to a succession of outfalls throughout the length of the brook. In either case the main drain is drawn with just sufficient fall across the slope, as deep as the outfall permits, until

a depth of four feet three or four feet six inches has been reached, which need not be exceeded. When one main takes a large extent of drainage water—as, for instance, that of half the farm in the case before us—it must be either a built conduit or a carefully-laid chain of the largest pipes, sometimes even as large as nine inches in diameter. It is, however, better to have a series of such outlets as have been already described; and to let every considerable field, as of fifteen to twenty acres, deliver its own water independently. In this case, the main for each such field, drawn along the lower side of the field across the slope, and at least eighteen to twenty feet from any hedgerow, either delivers its water into an open ditch taking it to the brook, or is continued downwards to an outlet at the brook. When drainage mains unite, as in the former case, it is a safe practice to provide wells into which both drains deliver, and from which the main below takes their united streams onward to the final outlet. These wells are sunk lower than the line of pipes, and so receive and collect any sediment. The annexed drawing (Fig. 6) gives the section of a smaller well of this kind, made of earthenware pipes, the top sunk level with the ground, and provided with a swivel cap to exclude dirt. Where a larger well is advisable, from the larger streams of water which are to meet in it and pass on, it must be made of brickwork, and provided with a man-hole, by which sediment may be removed. The position of such wells (whether small or large) is indicated in Plate I., where the actual drainage of an estate is represented in detail. The parallel minor drains are drawn up the slope from each main drain in succession, beginning with the one nearest the lower end of the main. Their depth may be four feet where they enter the main, thus delivering their water in at the top of the main-drain pipes; and when the fall is considerable, and the consequent flow of the water is rapid, it is well to give them a slight bend towards the outfall at their junction with the main, so as to avoid the abruptness of a rectangular junction. As soon as the main drain has been laid, either for the whole side of the farm, or for any of its fields along its lower side, you place in it pipe tiles from two to six inches in internal diameter, according to the quantity of acreage for which it has to answer; and then by experiment and inquiry you have to determine the distance from each other at which the minor drains must be placed. The “inquiry” should be directed to the experience of your neighbours on similar

Fig. 6.



soils ; the “experiment” should be performed as follows :—Dig at intervals of five or six yards across the slope a few trial holes four feet deep, shoring up their sides with strips of wood, kept apart by short bits the width of the hole. They will soon fill with water if the land needs draining, and you will be able to judge by the effect upon the water in them of your first minor drain, four feet deep, taken through their midst right up the slope from the lower end of the main drain, what the interval proper for your regular drains may be for that particular field. I have seen in the stiffest clays holes placed on the crown of a ridge, so that mere surface water could not run into them, filled to the level of the surface furrows in a few days ; and after the digging of a four-foot drain three or four yards from them, emptied in a few days nearly to the bottom of the hole. And in more porous soils the channels four feet deep beneath the land seemed to make at that depth throughout the soil a surface above which it was impossible for water to remain stagnant. Let it be added here, that economy upon the whole can be observed only by such a use of the wide interval in the lighter soils and subsoils as will save money to be spent in more frequent drains on clays. Taking, then, four feet as your ordinary depth of drain, you make the interval between them dependent simply on the porosity of the land. An interval of seven or eight yards may be needed for stiff clays, while twelve to fifteen yards may be sufficient on soils of easier texture ; and I have seen drains six and seven feet deep, cut at the cost of 4*d.* or 5*d.* per lineal yard, emptying holes naturally filled with water in a soil which would not be called a sand at a distance of fifteen yards and more ; so that a very few such drains provided all the exit needed for the water falling on many acres of land. Drains four feet deep will, if the clay or sand be homogeneous, cost for cutting rather more than 1*d.* per lineal yard ; and if the pickaxe be employed in digging them, they may cost double and triple this amount. They are dug at four “spits,” the operation of the spade or grafting tool after each spit being followed by that of the shovel or scoop to lift the loosened surface on which the drainer would otherwise stand in taking the next spit. A good drainer makes beautiful work—the sides of his trench are uniformly true and sloping, the groove he leaves at bottom is exactly the right size for the pipe, and the fall it has is uniform.* When this is

* A man of ordinary size can easily stand and work in a drain three feet deep if it be a foot to fourteen inches wide. He thus stands and takes out the last foot of depth without difficulty ; and in the case of a drainage match some years ago near London, the prize was taken by a labourer who dug a four-foot drain with only nine inches width at top. Of course it is to his advantage to dig a narrow drain, for there is less earth to lift.—A man can dig earth if not very hard or very loose, and place it in a barrow, for twopence per cubic yard. The higher lift and more awkward work in a drain makes the removal of the trench cost twopence-halfpenny or more per cubic yard in ordinary cases.

considerable, the tiles are placed at once, only ten or twelve yards of drain being left open at a time. When, however, the land is nearly level, the drain must be opened up from end to end before the tiles are placed, in order that, either by the standing of the water in it or by the use of the draining level, defects in the uniformity of the fall may be remedied before the drain tiles are placed. Many forms of drainage level have been designed. A spirit-level, even if understood by workmen, is a thing easily put out of order, and is at all times liable to be broken; instead of it, therefore, one of these simpler instruments is to be preferred. Whatever levelling instrument be chosen, it is first "set" by trial on the surface of the field, so as to represent by its index (this, in Mr. Denton's "A" level—a cheap and efficient instrument—is a plumbline traversing a horizontal scale) the average fall of surface from the top to the bottom of the line of drain. Of course, if in draining, the first object of the operator is to direct his drains according to the best fall of the ground, the next point of importance is that the floor of the trench should be even and regular from the top to the bottom of the drain. Any hollow in the drain intercepts the sedimentary matter which the flow of the drain-water would otherwise carry out with it; the sectional area of the water-way is thereby lessened, and the sediment, gradually accumulating, after a time causes a stoppage, the drain bursts, and the work has to be re-done. To hinder this, the level fixed for the average fall of the surface is placed from time to time in the trench. And (to take the case of the "A" level*) the fall has to be corrected whenever, on its legs being stretched apart and placed on the floor of the trench, the plumbline cuts the scale at any other than the point previously determined.

The drain tiles are simply cylindrical pipes: they are placed end to end without any uniting collar, except where crossing quicksands in the subsoil, or in case of very uneven texture of the subsoil, where they would be apt to sink out of a continuous line. Collars may, however, with advantage be employed along with the smallest pipes, and wherever any risk exists of fibrous roots entering the pipes and thus stopping them. The pipes may be of one-inch (or better $1\frac{1}{2}$ -inch) bore at the top of each drain, increasing to two-inch bore at the lower end. The first fifty or eighty yards in length of a minor drain may thus be laid with $1\frac{1}{2}$ -inch pipes; the lower half—and it is rarely wise to make a drain more than 150 yards in length—may be of two-inch pipes. When fields are upwards of 300 yards long, it is well to have an additional cross main half way up the field, into which the minor drains of the upper half may run. The cost of pipes (varying, however, in different districts) will generally be 10s. per 1000 feet

* No foreman sufficiently understands a spirit-level to systematize the drainage of a flat district—that must be left to the engineer; and the "A" level suffices for the work of the foreman.

at the kiln for every inch in diameter—more than this in the case of the large diameters—more than 50s. per 1000 for five-inch pipes, for instance, though less than 20s. for the two-inch pipes. I need not describe other materials for keeping open the underground channel of the drain. Broken stones are a cumbrous contrivance for obtaining an imperfect channel; they need a wide and large trench, and you had better cart pipe tiles several miles from the kiln than break or gather stones, though on the spot.

The digging of the drains is, of course, contracted for; the placing the pipes—an operation needing especial care, as on its proper performance depends the efficiency of the drain—should be done by a trustworthy man at day wages. The placing the pipes in heaps in the field in sufficient numbers, of the right sizes, and in the proper places, should have been directed by the foreman before the commencement of the work.

As to the quantity of superintendence needed as the work proceeds, I may mention that a large draining company employ one engineer, who inspects the successive estates which are placed in their hands, examines the essential features, designs the plan of operations, and forms an estimate. One foreman conducts the works of each estate, having under him a certain number of pipelayers apportioned to the number of diggers employed: A foreman can well overlook from sixty to a hundred men, and a pipelayer can follow from sixteen to twenty-four diggers, according to the nature of the soil. The duty of the foreman is to set out the drains according to the general design of the engineer—to whom he is accountable—to watch the execution of the work in all its stages, and to pay the men.

In illustration of the ordinary practice of land drainage, I give here a statement of the experience of Mr. John Girdwood, a well-known drainage engineer. He says:—

“I find it necessary to drain at from eight to ten yards on the Wealden and Oxford clays; at from ten to twelve yards in the clays of the red sandstone, where there is an uniform, homogeneous, so called clay subsoil. In such cases, the usual depth I employ is four feet for the minor drains and 4ft. 3in. for the mains. I use two-inch pipes without collars in such cases, and mains of three, four, five, six-inch or more, as may be needful. I generally try to obtain a somewhat uniform velocity in the mains and minor drains by disposing the main in such a way as to have a good fall. If this cannot be done, I use a large-sized main calculated in size to meet the difference in velocity of flow. I endeavour to keep mains a good distance from hedges, introducing minor drains if necessary on the lower side, as I find it nearly impossible to guard by glazed pipes cemented, or such like, against the entrance of roots of trees; and you may, if you please, have a specimen for illustration from

this office of a four-inch pipe filled with elm roots for a length of twenty-nine yards in one year and ten months, the nearest point to the tree being ten yards. In some of the gypseous clays in Derbyshire and Staffordshire I have gone to great depths. In one case at Sudbury, the seat of Lord Vernon, I have drained about forty acres at a depth of from eight to eleven feet. The drains are sixty-six yards apart, and have been perfectly successful. This land had been twice drained, I believe, and was as wet as ever. I dug down in a dry time, finding no great rush of water till I got to about eight feet. It then began to flow, and at ten it rushed in with such force that the workman had to be hauled up. This determined my proceedings. The levels were carefully set out and the work commenced by a great nine-inch socketed main. The men worked in shields to protect them against slips. Half the soil was thrown out, and the other half thrown back on the pipes, which were laid as the work proceeded. The main flows nearly full, summer and winter.

“Where gravel beds occur in the clay or under it, they often permit of wide intervals being used with perfect success. I have drained nearly 200 acres of this kind of subsoil at Sudbury, at six feet deep, and at intervals of forty-four yards, with the greatest success. Sometimes we meet with very porous beds, where the land, though full of water, may be laid dry with drains of moderate depths at very wide intervals. I lately met with a remarkable instance of this in Oxfordshire, on the Earl of Shrewsbury's estate at Bampton. On one side of the town the immediate subsoil is the Oxford clay, well known for its stubborn retentive qualities: on the other side, however, there is an extensive superficial deposit of gravel full of water; so full, indeed, that when first examined it was not possible to cut trial holes at all, as the trench filled with water to within twelve inches of the surface as fast as it was dug. Owing to the flatness of the country, it was not possible to get an outfall of greater depth than five feet; but when the first field was drained, all the shallow wells within a quarter of a mile in one direction were laid dry, and several adjoining fields were also drained by means of it. The drain was a large one, but it had to be taken up and one twice its size substituted.

“As to cost, I find at the present time we are paying for four-feet cutting in clays free from gravel, 6*d.* to 6½*d.* per rod; with some stones, 6½*d.* to 7½*d.*; very stony, 8*d.* to 9*d.*; and with large stones and shaley beds, 10*d.*: 7*d.* to 8*d.* may be taken as the average price for cutting out and returning the soil after the pipes are laid. We expect good men working hard to earn 3*s.* per day, and wish them to do so. We lay the pipes by day work; and this, with cleaning out and so forth, costs about ½*d.* a rod, or a little more. Laying pipes, and superintendence, costs about 10*s.* per acre, including all

usual day work. The cost of 10-yard work is on an average as follows:—

88 rods of main and minor drains at 8 <i>d.</i>	£2 18 8
Day work and superintendence	0 10 0
1400 2-inch pipes at 20 <i>s.</i>	1 8 0
Main pipes (per acre)	0 3 0
	£4 19 8

“In practice, however, we seldom dig the full number of rods due to the acres used, and so the cost would be rather less. If an engineer is employed to place the drains, then 5*s.* per acre must be added. Where the pipes are made on the estate, 10*s.* per acre may be deducted, as with coals at 16*s.* per ton first-class pipes may be had at from 13*s.* to 14*s.* per 1000. I find nine yards wide and four feet deep drainage in the Weald of Kent, including carriage of pipes and engineering charges, comes to 5*l.* 4*s.* 6*d.* per acre, the cutting being 7*d.* to 9*d.* per rod. Drainage ten yards wide and four feet deep in the red sandstone clays of Herefordshire, exclusive of carriage of pipes and engineering charges, costs 4*l.* 7*s.* 6*d.* In the same clays in Gloucestershire, but having many small stones, the cost was 4*l.* 10*s.*, but the pipes were made on the ground and haulage was paid for; engineering charges also were paid. In the same class of soils in Shropshire, the cost is a little higher (about 7*s.* per acre), as wages are rather higher. In the limestone districts where there is much limestone brash in the subsoil, 5*l.* 10*s.* to 6*l.* is about the cost of ten-yard drainage. In the slaty shaley clays of Wales labour is bad, and therefore costly, and pipes dear and scarce; 6*l.* 10*s.* is therefore no uncommon cost per acre there. On the other hand, where the intervals are very wide the cost is sometimes trifling in comparison, or under 3*l.* per acre.”

The following table indicates the cost of the whole operation under varying circumstances.

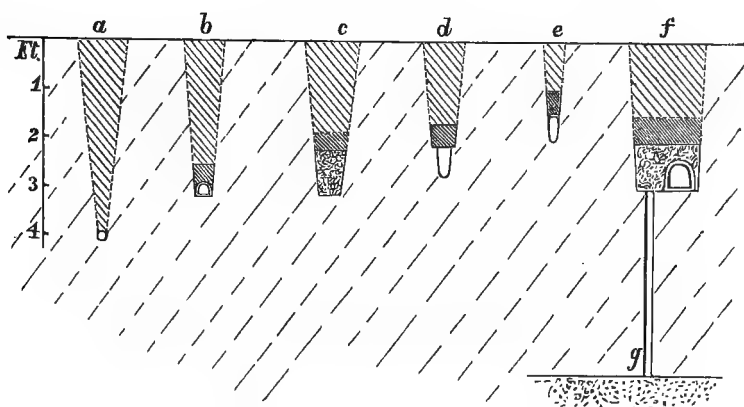
Drains at intervals of	Length of all drains per acre.	Cost of cutting per acre		2 in. tiles per acre at 20 <i>s.</i> a 1000.	Collars.	Filling tiles and earth 1 <i>d.</i> per perch.	Extra work on mains per acre.	Total per acre	
		at 6 <i>d.</i> per perch.	at 8 <i>d.</i> per perch.					at 6 <i>d.</i> per perch for cutting.	at 8 <i>d.</i> per perch for cutting.
yards	yards	£ s. d.	£ s. d.	£ s.	s.	s. d.	s.	£ s. d.	£ s. d.
5½	880	4 0 0	5 6 8	2 10	5	13 4	3	7 11 4	8 18 0
8	605	2 15 0	3 13 4	1 16	5	10 0	3	5 9 0	6 7 4
11	440	2 0 0	2 13 4	1 5	5	6 8	3	3 19 8	4 13 0

To this should be added 5*s.* an acre for superintendence, if you do not undertake that yourself.

Sections of the different forms of drains in general use, are given in Fig. 7, where *a* gives the transverse dimensions of an ordinary 4-

feet minor pipe-tile drain, the main into which it runs being deeper, and provided with a larger tile. The probable efficiency of such a drain as this may be contrasted by means of this drawing with that

Fig. 7.



of drains *b* and *c*, which are the deepest drains known to the old Deanston system—the one using the costly horse-shoe tile and sole, and the other the still more costly broken stones, covered with an inverted turf. The so-called “wedge” drain, referred to in another paragraph, is represented at *d*, and the “plug” drain, still adopted on pasture lands in Gloucestershire, also described hereafter, is represented at *e*. The large conduit, with auger bore, for removal of spring water from deeper porous beds where it is lying under pressure, is shown at *f*.

Of open ditches, it must suffice to say that they should, if possible, be avoided: when they are necessary, as in the case of provision for a large, and more especially of a variable body of water, they must, of course, be deep enough to afford a rapid exit for the water of the mains flowing into them. And in making them, their sides should slope at least 45° , more or less, according as the subsoil through which they are cut is loose or firm, and so more or less liable to slip.

Open ditches are needed in boggy soils, or in peat bog itself, as a preliminary to subsequent efficient underground drainage. An opportunity is thus given for washing out salts of iron, and for the escape of the pent-up water and the subsidence of the land. Under this class of open ditches may also be named the practice of surface drainage, which has been found of great use in drying mountain pastures, and thus improving the herbage and the health of the flocks which depasture it.

“Sheep” drains, for taking off swamp water, can be made for

1½*d.* per rod, fifteen inches deep and eighteen inches wide. They act by confining surface currents, and intercepting springs, and so checking the extension of marsh land.

Of expedients for cheapening land drainage, I may name the following :—

1. *The use of faggots*, or even of straw rope laid along the bottom of a trench, and then covered carefully with the earth taken out of it, has long prevailed in Essex. It is not likely to extend beyond the district of its “use and wont;” and though for a time unquestionably beneficial, it is not to be defended against the more permanent plans which have been described, except upon the plea that the tenant who performs it is at any time liable to a notice to quit, and cannot therefore undertake a better and more costly operation.

2. *Wedge draining* consists in the third “spit” taken out being narrower than the second, leaving on either side of it therefore in the open trench a shoulder, on which the second spit will rest when returned to its place, and so a vacant channel is left below it which acts as a drain (see *d*, Fig. 6). It is to some extent available as cheap drainage, both on peat and on clay land.

3. *Plug draining*, a practice adopted to some extent on grass lands in Gloucestershire, costs 3*d.* per perch when twenty-four or thirty inches deep. A narrow trench is dug that depth, and a flexible core, consisting of a number of wooden blocks linked together, of a size to fill the bottom of the trench four inches high, is placed in it, and the earth is filled and rammed in hard above it, and it is then drawn along a couple of yards or so, and the process is repeated. A channel is thus left (Fig. 7), which acts for a number of years as a drain.

4. *The mole plough*, drawn along by horses, either directly, or by chain and capstan, or by steam power, also leaves a channel in like manner, which in clay lands remains open for a number of years.

A method of drawing in a chain of pipe-tiles behind the “mole” of such a plough has occurred at different times to more than one person, and has been carried out by Mr. John Fowler over large extents of ground with great success. He has used steam power thus to drag pipes strung upon a wire rope into drains three and four feet deep. The engine stands in an upper corner of the field, and the draught rope which it works is drawn round pulleys anchored here and there, according to the line in which it is desired to work. Holes are dug along that line at intervals of sixty or eighty yards, and by each there lies a corresponding length of rope with pipes strung on it. The mole plough, commencing at the lower end of this line, draws after it first one and then another of these strings of pipe tiles, and each string is detached as soon as placed. The empty rope is drawn out, and the new one hooked on in its place; and the junction of the successive lines is effected at

these holes by hand ; and when filled in there is thus a continuous line of pipes from one end of the field to the other. When the subsoil is of uniform consistence, and the surface is of tolerably uniform slope, Mr. Fowler's plan is perfectly successful. On this uniformity of slope depends the uniformity, in this case, of the fall in the drain itself ; and on *this* again, more than on any other thing, depends its safety from stoppages.

5. *The Keythorpe system.* The drainage of Lord Berners' Keythorpe estate was effected by the extensive use of trial holes, no more minor drains being cut than sufficed to empty all the holes that had been made. And the late Mr. Joshua Trimmer having observed in Norfolk and elsewhere, when examining the surface geology of the country, that the under bed of clay was often deeply furrowed before the lighter drift of which soil and subsoil there consisted had been laid upon it, believed that in the existence of these filled-up furrows in the under clay he saw the explanation of Lord Berners' practice and experience.

In the so-called Keythorpe system, accordingly, the furrows on the surface of the under-clay formation, sometimes occurring beneath a porous subsoil, are themselves used as drains, conduits being cut across them to give an exit for the water which they hold. A single drain cut across these furrows is supposed to be enough for a large extent of land, the furrows which it cuts across being thus, in fact, the drains running, as into a main, into the conduit thus made. The advocates of this system say that these furrows generally run up and down the slopes of the land, and thus drains cut without regard to them may be comparatively inefficient, from being cut wholly in the clay where the porous subsoil over it is very shallow ; while between these drains, and therefore hardly affected by them, there may be one or more of these furrows in the clay filled with the porous subsoil, and therefore filled with water.

The Keythorpe drainers accordingly dig holes at intervals in the field they are about to drain, and then taking a single conduit up aslant the slope after the holes are filled with water, they observe which of the holes it empties, and so judge of the position of these porous furrows, whose existence they infer rather than observe. Having determined, as they think, the direction of these furrows, a single main across them here and there is all they provide. These furrows, in place of being reservoirs of water, then really become the drains on which the drainer depends. The objection is, that the furrows are of different depths, and that a conduit of uniform depth cannot be depended on to empty all : and that at best the system is but a contrivance for taking the water from a body of earth of varying depth, leaving the comparatively impervious subsoil really undrained. You do get rid of surface water, but you do not thus obtain that full increase of fertility which drains confer

when they induce motion in the water lying in soil and subsoil three or four feet from the surface throughout the field.

6. It may be right to name Lord Wharnccliffe's scheme for draining sloping clay lands. It gets the name of the *herring-bone* arrangement, and consists of a deep drain here and there up and down the slope, with shallow drains branching from them at an acute angle with these deeper mains. It has the practical objection of a number of junctions liable to disarrangement, and it is especially in fault as being a shallow drainage, which must interfere with the deeper tillage operations of the farmer.

7. Among cheap expedients may be named the deepening of the minor drains in order to increasing the interval between them. This was more generally advocated formerly than it has been of late. Experience has proved that on clay soils a certain frequency is necessary, whatever depth be adopted. On more porous soils and subsoils, however, an increase of depth, as already related by Mr. Girdwood, does enable you to dispense with many drains, and so to cheapen the operation.

8. I may mention here, too, the practice of *furrow-draining*, as compared with a uniform drainage, without regard to the surface configuration of the land. Where these furrows are between steep and permanent ridges, the practice seems unavoidable; but is to be defended only on the same grounds which justify a preliminary drainage of old water-courses before the uniform drainage of the land commences. If this furrow drainage is alone depended on, it will result in the rain flowing over the surface of the land, and sinking in through the moved soil of the drainage trench, instead of sinking where it falls, and finding its way through the subsoil to the drain. When these furrows are straight and of a proper interval from one another, drains may indeed be made in them; but this should be only preliminary to a gradual levelling of the ridges by repeated cross ploughings of the land, in order that ultimately such surface divisions as may be considered useful in guiding the labour of the crops may be arranged irrespectively of the position of the drains.

9. *Shallow drains in pasture lands.* Some drainers of experience believe that shallower drains will serve equally well with deep ones upon pasture lands. I can only say, though not from a very large experience of drainage in the case of pasture lands, that this idea appears to me inconsistent with any other than the imperfect theory which supposes that we drain in order to get rid of water which interferes with tillage operations; the fact being, that we drain to make use of water. And the pasture grasses of our meadow lands will benefit by that movement of the water in the subsoil effected by deep drains, which is the main purpose that they serve, as much as the roots of wheat and turnip crops are benefited by it on our arable lands, where deeper drains are unanimously preferred. No

doubt, as a first result of any perfect drainage of grass lands, water grasses may die out, and so an injury may, apparently, for a while be done; but this will be ultimately succeeded by a more luxuriant growth of better grasses, to the permanent improvement of the pasture.

10. *Air drains.* As affecting the efficiency, rather than the cheapness, of land drainage, I should here name the theory and the practice of Mr. Hutchinson, of Grantham, who believes that an air drain, connecting all the upper ends of the minor drains with the surface, will tend to their more rapid action. It is an idea which seems to me to have no real foundation. If soil were air-tight, then, indeed, Mr. Hutchinson's theory and practice would be correct; but they are not air-tight; indeed, they are not, happily, even water-tight. If they were, no drainage would be possible, whether they had a connexion with the air or not.

Of stoppages in drains it may be well to refer to one or two instances. (a) Drains become clogged sometimes where there are undulations in the fall by the deposit of particles of the peroxide of iron. In ferruginous soils, especially of a peaty or vegetable character, if undrained, iron sometimes exists in its lower state of oxidation, when it is liable to solution in water containing any vegetable or other acid. If in that state, it be exposed to air (as by leakage into the drain it is), it becomes oxidized and decomposed, and the peroxide of iron which is thus precipitated will, if not carried off by a uniform flow, cling to the pipes, or accumulate at any slower part of the current in them, and so ultimately stop them altogether. The remedy in very ferruginous soils is to open the land up with ditches before its under-drainage is commenced, so that the mischievous soluble iron-salt may be either washed out or oxidized within the soil. The application of lime to the land will also decompose the iron-salts within the soil, and so tend to facilitate the oxidation which is desired. In any case, defect in the uniformity of fall within the drain will give occasion to stoppage arising from solid particles carried by the stream; and hence the smallest pipe consistent with the largest probable flow of water is best to use, because in these when the flow is little it will be confined in a narrower rill, and so be better able to transport whatever particles it holds in suspension.

As to stoppages by roots of plants, there is no remedy which does not involve the uselessness of the drain itself at the place where that remedy is applied. If the junction of the pipes be so perfect as to exclude the fine fibre of a root, it will also exclude water, and so be useless as a drain for that particular spot. It will, however, be best to make it thus useless, except as a main carrier for water whenever it crosses hedgerows or passes near to hedgerow trees. And this is effected by using long and tight collars for the pipes;

or even, if necessary, by throwing mortar in above the tiles when placed ready for the refilling of the earth above them. For stoppage by the roots of mangold wurzels and other green crops, which have sometimes been observed, there is no help; except it be in placing the drain at least four feet deep, and in such thorough and deep tillage of the land as shall distribute the shower evenly throughout it, and so hinder the formation of any special stream of water within the soil (such, for instance, as Mr. Smith, of Deanston, contemplated towards his drains), which would guide the roots of plants into the drains, where they soon astonishingly develope—to the entire filling of the channel. Deep stirring tends not only to the uniform distribution of rain-water and of roots throughout the subsoil, but also to the efficiency of land-drainage, whatever system be adopted. And either the use of the subsoil plough—which was an essential part of the Deanston system—or the deep-stirring of the land by some other means, should always follow drainage. Shallow cultivation tends to the formation of a crust or “pan” beneath the surface. The hardened floor on which the horses have trod while ploughing for a century or more, has become nearly impervious to water, and must be broken up before the drains can act efficiently.

As a last word upon the methods of land drainage, let me impress on you the need of thorough work. It is as true in agriculture as in every other thing, that nothing is stronger than its weakest part; and a patch in a field left undrained, though all the rest be dry, will often stop the whole tillage of the field, and even hinder the application to it of means which, had it not been for this partial failure in one spot, would have influenced for good the whole produce of the farm.

On the Results of Land Drainage.—Among them may be enumerated greater facility and economy of cultivation, more rapid plant-feeding, and an underground climate which, if not changed to the feeling of animals, is wonderfully changed as to its influence on plants. They are thus started earlier in spring, and kept more continuously growing, being less dependent on changes in the temperature of the air. And they are thus brought earlier to maturity. Harvest has been made a fortnight earlier on individual farms by the mere influence of land drainage. Manures which were formerly washed to waste exert their full influence on plant growth in well-drained land. And tillage which on wet lands is often mischievous, exerts after thorough drainage, and on land in proper state for it, the wonderful influence for fertility which it possesses. I will quote once more a passage on this subject from Mr. Girdwood’s communication to which I have already referred. He says:—

“In some cases in my practice, as for instance at Mr. Wilmot’s in Cheshire, land not worth 10s. per acre per annum has been made

worth 3*l.* by an outlay of 6*l.* per acre. I saw a fine instance of benefit lately, where land which would not grow turnips at all worth having was drained, and turnips sown against the advice of neighbours. The farmer was fairly nonplussed with his crop; it could not be less than thirty tons per acre, and he neither had stock to eat so much, nor hardly power to cart it off the field—in fact, he realized *Punch's* farmer complaining of the trouble of having to build a bigger barn. A farmer in Worcestershire told me the other day that he found the drainage done last year worth twenty per cent. on his rent at least; two years ago the same man would not hear of having his land drained. In Shropshire the estimate over a large estate is that the drainage has added from six bushels to eight bushels of corn and ten tons of turnips per acre to the crops. On the Cloverley estate of Mr. John Whitehall Dod, M.P., in the same county, there is a remarkable instance of the money value of drainage. On a small farm there (ninety acres) the tenant used to be able to keep only nine cows. Forty-five acres of his land have been drained, and this year he has increased his stock of cows to seventeen, and he has no doubt that next year he will be able to keep twenty, his other stock and arable land remaining as they were before the drainage; so that he has gained the keep of thirteen cows at a cost, say of 13*l.* per annum of drainage interest. Everywhere the farmers are now pressing on us to drain their land as fast as possible, where a few years ago I had to use my best persuasion even to get a single field done. And it is most gratifying to find that they all become ‘deep’ drainers as soon as they see the *not-less-than-4* feet work tried. In fact many of them who have themselves drained at thirty inches and three feet now ask to have the work done over again by us at four feet or upwards.”

I have thus gone into some detail on land drainage in the month of January; for, although such work should have been commenced as soon after harvest as possible, and may thus have occupied the autumn and earlier winter months, yet it is everywhere being carried on in January; and there is a fitness in commencing an agricultural book with a full account of what lies at the bottom of all agricultural improvement.

II. COMPOSTS AND MANURE HEAPS.

All manures are composts. The growth of plants involves the building up of a great variety of materials; and manure, which is the food of plants, helps the natural supply of almost all the ingredients thus required. Of some there may be unlimited abundance in the air, and of others the soil contains enough; and yet even of these an artificial addition tends to the increase of fertility: while of others the natural store is so limited, that on the attention of

the farmer to this important part of his business depends from year to year the crops he may expect. The manures he adds contain many of the necessary ingredients, and they are so far *composts*. It is necessary that these ingredients be thus combined and mixed, not only because the greater the variety present the greater also will be the power of the mixture to meet those wants of a rapidly growing plant which arise out of an imperfect natural supply in the soil where it is growing—not only because in such a mixture one ingredient often detaches others from combinations in which they are lying dormant, and so makes them useful that the total fertilizing effect of the mixture is greater than the sum of the fertilizing powers of the separate ingredients would have led you to expect—but also because that chemical action in which the growth of plants consists, requires for its continuance that the atoms which are thus built up within the growing structure should be successively presented in a nascent, *i.e.* just detached condition. On analysing any product of a plant after the completion of its growth, various elementary substances are found—carbon, hydrogen, nitrogen, oxygen, chlorine, phosphorus, and certain metals. None of these substances would be useful as manure applied alone. But substances containing them are sucked in by the leaves and roots of plants; and being decomposed within the plant by the varying play of chemical affinity under the influence of light and heat and life, these substances yield up their ingredients in that just-detached or nascent state when chemical affinity exercises the greatest power; and by it accordingly they are at once rebuilt as the habit of the plant directs. Carbon thus enters the plant as carbonic acid gas, being absorbed from the air by its leaves, and (washed into the ground by rain) sucked in by its roots. Oxygen and hydrogen enter it combined as water and in various other ways—nitrogen in ammonia, nitric acid, &c.—chlorine in common salt, which contains it combined with the metal sodium—phosphorus in phosphoric acid, as contained in various soluble phosphates. Any soluble substance which contains any of these ingredients, combined or mixed, is a manure from which plants can feed themselves, and grow.

And they are contained in farm-yard dung—in all vegetable and animal substances—in many mineral substances, as marl, lime, clay, and various mineral salts—in many wasted substances, as the sewage of the town, and the refuse products of many of the manufactures—in many imported substances, guano, bonedust, nitre, &c. Many of these ingredients are now used in the manufacture of artificial manures, in which they are rendered more soluble, and mixed in proportions more adapted to the presumed requirements of different crops. Of these I shall speak in March, when your purchases of them should be made. To clays, marls,

and lime, reference will be made in the autumn, when they are more generally applied. It is the management of the dung heap which will occupy our attention now.

After the life has gone which holds the ingredients of a living plant together in the forms its several products there presented, their former and natural chemical affinities, which have been held in abeyance by it, again come into play. And these products thus tend to resume the former combinations out of which they arose. This process is hastened by the presence of heat and moisture. In any moistened heap of vegetable matters accordingly, the work of decomposition goes on with rapidity; and the oxygen which had been given out to the air during the growth of the plant is re-absorbed, to enable the resumption of the old condition of things. If, therefore, the heap be moved occasionally, so as to let the oxygen of the air have free access to it, the process is quickened, and the rotting goes on rapidly. The old affinities coming into play, the old combinations ensue; and so, the carbon and the hydrogen reunite with oxygen, forming carbonic acid and watery vapour, both of which fly off into the air from which they originally came, the nitrogen resumes the form of ammonia and also escapes, and the minerals are detached from their fixed positions in the vegetable, and are liable to be washed away.

This is, in fact, the process which goes on in a dung heap. The straw and other vegetable matters are there mixed with the dung of animals which, generally containing more of the nitrogenous ingredients of plants, is more liable to this re-arrangement of its elements, and thus acts the part of a ferment; and the whole accordingly rots rapidly in contact with the air, and thus great waste ensues. The skilful management of the dung heap succeeds in checking this waste, and saving the volatile and soluble substances which, if unrestrained, escape. It thus secures for the soil, and the next crop upon it, materials which would otherwise be wasted.

In whatever way the materials of our dung heaps are gathered together, there is a considerable store accumulated by January; and as, during the frosts of winter the land is fit for carting on, a good deal is generally carried to the fields this month.

When cattle are fed in open yards, the dung may be either carried out now, or left till spring, and then turned over and made fit for application to the land at once. This, however, is a most wasteful practice; for the manure thus suffers the greatest possible exposure both to air and rain water.

When cattle are fed in covered yards, such a method is economical and efficient enough; as the dung so made is not then exposed to the washing of rain-water. When stall feeding is adopted, the soiled litter is thrown daily into the yard, either covered or open; or it is carried daily to the heap, and there covered with earth.

When box feeding is adopted, the litter accumulates under the cattle, and the boxes are cleaned out only at intervals of months. It is then cut out and carted to the field, and either spread at once and ploughed in, or, if this cannot be done, carted to heaps in the fields where it is to be used. When carted together in January, the carts should be driven over the heap, which should be about four feet high. This treading down excludes air, and so checks the rotting process. Later in the season the carts are backed against the heap, which, lying more loosely together, ferments more rapidly, and so the sooner acquires that rotten texture which enables it to be easily buried under the surface, or perfectly mixed with the soil. In any case, in order to the retention both of the volatile and the soluble products of this fermentation, the heap should be laid upon a bed of loamy soil, about six inches deep, and covered with a layer of such soil three or four inches thick: and when the heap is finally mixed together, before being carted out, this earth, rich with ingredients that would have been lost, should be mingled with the mass.

On the covering of dung heaps, I quote Mr. Laurence, of Cirencester. He says of the plan which he has adopted:—

“Some three or more spots are selected, according to the size of the farm, in convenient positions for access to the land under tillage, and by the side of the farm roads. The sites fixed on are then excavated about two feet under the surrounding surface. In the bottom there is laid some three or four inches of earth to absorb any moisture, and on this the manure is emptied from the carts. This is evenly spread and well trodden as the heap is forming. As soon as this is about a foot above the ground level to allow for sinking, the heap is gradually gathered in until it is completed in the form of an ordinary steep roof, slightly rounded at the top by the final treading. In the course of building this up about a bushel of salt to two cart-loads of dung is sprinkled amongst it. The base laid out at any one time should not exceed that required by the manure ready for the completion of the heap as far as it goes; and within a day or two after such portion is built up and it has settled into shape, a thin coat of earth in a moist state is plastered entirely over the surface. Under these conditions decomposition does not take place, in consequence of the exclusion of the air; or, at any rate, it is to so limited an extent that the ammonia is absorbed by the earth; for there is not a trace of it perceptible about the heap, though when put together without such covering, this is perceptible enough to leeward at a hundred yards’ distance. The base may be ten to twelve feet wide, and the roof about nine feet from the base, which settles down to seven feet. The heap may extend to any length as further supplies of manure require removal.” “When heaps thus formed are resorted to in the autumn, either for the young seeds or for

ploughing in on the stubbles after paring for the succeeding root crop, the manure will be found undiminished in quantity and unimpaired in quality—in fact, simply consolidated. Decomposition then proceeds within the soil, where all its results are appropriated and rendered available for the succeeding cereal as well as the root crop.”

Manure thus treated which has been either made in boxes or in covered yards is managed perfectly—none of the products of such fermentation as it undergoes are lost; and its fertilizing powers are proportionately greater. Dr. Voelcker has ascertained that dung made in open yards contains less of those ingredients on which its powers as manure depend, than dung made in boxes and properly preserved. And Lord Kinnaird has proved by remarkable experiments in the field that the latter is far more efficacious in inducing crops both of wheat and of potatoes than the former.

A correspondent, in 1852, of the *Agricultural Gazette*, spoke thus of the three ways in which alone manure is perfectly saved; viz.,—

1st. The plan now general over the better-farmed counties, of ploughing in fresh manure on the autumn stubble, in preparation for the succeeding green crop. (See OCTOBER.) 2nd. The plan of liquefying the whole exuviae for distribution by steam power and iron pipage over the land. 3rd. The plan explained by Lord Kinnaird of having the manure made in covered court-yards. He testifies to the excellence of the third plan.—The droppings and soiled litter of stall-fed cattle, and the same from the work-horse stable, are daily thrown into a walled and covered pit, care being taken that they are intermixed. A dozen feeding pigs are kept in the pit; any loose litter there may be found lying about, together with road scrapings and odds and ends of animal and vegetable refuse, are thrown in; the pigs mix and incorporate the whole well together. From time to time liquid from the manure-tank is pumped in; and thus we have generally a deposit of a considerable quantity of well-made manure at hand, to supplement the dung heaps when they are exhausted. These (the dung heaps) are managed on a system which is simple and efficacious. The manure is carted out as the boxes become full, and thrown out of the carts into a heap of five feet in height by twelve feet broad. As we advance in this building we follow with a cover to the top and sides of clayey mould. This cover is at first about six inches thick. The still open side, to which we are adding, admits a small degree of atmospheric action, which induces a gentle heat. When this has gone on for three or four days, we add three to six inches more clay or soil, over which we pour dilute urine. This keeps the fermentation going on in the heap, the gases from which have to permeate the clay ere they can reach the atmosphere, and the now well-known absorption of ammonia by aluminous earth, prevents any waste. Indeed, with manure taken from covered

boxes, there will not be any escape of vapour from the clayey covering till the dilute urine is plentifully applied; even with manure made in courts exposed to rain, there will be an escape of nothing but of watery vapour; a loss which is a gain, as there is less weight afterwards to cart on the ground.

"In ten days after the heap has been made, it will, if it has been properly attended to as above, be fit for using in bean or potato drills, being soft and unctuous; it is cooked in its own steam. Should it not be required for a month or longer, all that is necessary is to give it a coat of six inches more clay or mould, and it stands ready to be cut up when wanted. I find this system to work exceedingly well. I am satisfied that from seventy loads of manure, carted out and covered with thirty loads of clay, I have a larger store of fertilizing elements than I should have from one hundred loads of similar manure carted out and trenched up in the old mode to ferment."

This conservative power of clayey loam over the fugitive products of the rotting process in the dung heap is a point of great agricultural importance; and wherever there is any collection of fecal matter which it is desired at once to save and disinfect, this is the best material to mix with it for the purpose.

The Rev. H. Moule, of Fordington, Dorsetshire, has called attention, in a lately published pamphlet,* to its uses in saving house waste for the garden; and its services in agricultural economy have been attested above.

Liquid manure may be used as it is made, by soaking manure heaps, or it may be hoarded up in tanks till spring, and carted out in water-carts on the land. It must not be forgotten that the value of manure depends not only upon its nitrogenous or ammoniacal compounds, but also upon its mineral parts; and it differs greatly in these, according to the food and age and condition of the animals which produce it. It is believed that the greater value which every farmer recognises in the dung of cake-fed beasts, arises chiefly from the greater quantity of phosphates which it contains; those phosphates being contained in the food of the cattle. And the great difference in the value of their manure between a full-grown half-fat ox, and a milch cow or a young beast, arises from the latter requiring all the phosphates in their food, one for the growth of its bones, and the other for the secretion of its milk; while the former, requiring them for neither of these purposes, passes them in its manure. Manure also depends for some of its value on its bulk—its influence on the texture of the soil; but this, while sometimes beneficial, as on clay soils, where it ought to be applied fresh, is sometimes injurious, as on light soils, where, accordingly, it ought

* "National Health and Wealth." Bradbury and Evans, Bouverie Street, Fleet Street, London.

to be kept, if this can be done with safety to its volatile ingredients, till it is rotten and of an unctuous texture.

Distribution of the Manure Supply.—You must bear in mind, in allotting your manure to the several fields, both the probable quantity of farm-yard dung which will be at your command before the seed time of the several crops, the artificial assistance which you are to give them by bought manures, and the condition in which the land was left by the preceding crop. Mangold wurzel should receive a full dressing of dung along with artificial manure, and thirty cartloads per acre ought to be taken to the mangold field. Turnips should receive at least a half dressing of dung, though in the south we often depend on superphosphate and bone dust alone for our crop. The potatoe fields must have a supply of twenty to thirty cubic yards per acre if they were not dunged in the autumn; and that for the beans, if not long since ploughed in, should amount to nearly as much. It is well to cart out dung in the autumn for the clover stubbles before they are ploughed up for wheat; if, indeed, a dressing was not given in the previous autumn over the young seeds: and if not done before, this dressing should be given now. And, if possible, it is also well to have a sufficient store preserved in heaps like those just described, for use upon the corn stubbles in the autumn, when as much land as possible that is intended for early sowing in the spring, should be cultivated and manured. All land, especially for beans, for potatoes, for mangold wurzel—and all clay lands for whatever crop, should thus have been prepared before this time for the crop to be sown upon it in the spring.

III.—TILLAGE OPERATIONS.

These—including ploughing, deep stirring with the cultivator, &c.—are efficient just in proportion as the land is dry when they are done; accordingly, as soon after harvest as possible is the best season for them. The air is, as already said, a great storehouse of manure for plants, and the more of *it*, as well as of things more commonly called manure, that you can get mixed with your soil the better. It too, like other manures, is useful in proportion to its thorough mixture with the soil. Every little particle of earth, though moist itself, should thus be wrapped in air; and where the land is drained every shower that passes through it will draw fresh air in, so that these particles shall be able to absorb fresh supplies from it of the fertilizing ingredients which it contains. ~~Detailed reference will be made to this hereafter; it is named just now as indicating that this month of all the twelve is generally the least adapted to tillage operations.~~ Only rarely, in dry seasons, or when necessary work has been previously delayed, does the plough properly find work in January. Corn stubbles may in rare cases still be left unploughed,

and should be turned over as soon as possible—or the ploughing of sward for oats may have to be done. Land, too, the tillage of which has been delayed by drainage operations may, when dry, be ploughed. This will be done irrespectively of the direction or position of the drains; but if ploughed up and down in lands of the same width as the intervals between the drains, these intervals had better be ploughed “out,” so that the drains shall be in the “crowns” of the future lands. In a flood time the surface furrows of the land are useful for hindering the stagnation of surface pools; and all clay lands especially ought to be water furrowed—*i.e.*, so provided with surface furrows as that water shall run off the land if it comes down faster than it can sink in; but the more that you can look upon these surface furrows as the mere accidents of your plan of ploughing, or useful only as a guide to future work, whether in sowing, hoeing, or harvest work, the better condition will it prove your land to be in. Never mind, therefore, how these surface furrows lie with reference to the position of your drains.

IV.—SOWING OPERATIONS.

1. **Wheat.**—The common rule to avoid sowing wheat for a month or six weeks about Christmas time, dependent for its authority solely upon the usual condition of the land, expires some time in this month. But whenever the land is not sodden with water, or will not poach under the horses’ feet, wheat may be sown. Its usual seed time is October and November, and then the character of its different sorts will be described. At present it may suffice to say that any of the common winter wheats may still be sown. Later in the season, the Talavera, a hardy white wheat, with a very loosely packed ear, but yielding well grain of good quality, is to be preferred. And, later still, the red, bearded, so-called April wheat must be sown. In well-tilled and drained land, six or seven pecks are ample seeding for an acre through this and the following month. It should be drilled in rows from six to twelve inches wide, the harrows preceding and following the drill; and it is generally found to succeed best on a stale furrow—*i.e.* when sown some weeks after the last ploughing.

2. **Oats.**—Early in this month, if the weather be open, it is well to examine such fields as are intended for this crop, and consider, if there be any apprehension of being full of business in February and March, whether it would not be well to lessen the work of those more busy seasons by sowing some oats now. The temper of the soil must govern this, but it is necessary to know that oats sown so early succeed well. This has been proved by ample experience. And in the earlier editions of this work, experiments made so long ago as 1785, in proof of the advantages of early sowing, were re-

corded. Of these the account of that by the late Earl of Winchester may be still read with advantage.

The Earl remarks: "I was induced to make the following trial, from having seen upon two very capital farms in Kent and Essex, great crops of oats sown as early as Christmas week, and from being informed by the gentlemen who occupied those farms, that they always sowed their oats as early as that, if the season admitted of it; and that they thought it the best time for sowing that grain. I wished to ascertain whether this plan would answer in a more northern county. The general time of sowing oats here is from the beginning of March to the end of April; and it is the opinion of most people here, that oats sown much earlier would be liable to be destroyed by spring frosts. Last winter was very favourable for the experiment, as the weather was open at Christmas for sowing, and the frost in the spring not severe. I divided a field of eight acres equally: one half was sown the day after Christmas day; the other half the middle of March. Five bushels per acre were sown broadcast on each part, and the same oats; the sort a small white oat, here called short smalls. The early sown were ripe and cut one week before the others; they were harvested equally well, without being exposed to any bad weather. I had a rood of each set out very carefully in the middle of the field, reaped and thrashed as soon as carried. The produce and weight were as follows:—

	<i>Winchester Bushels.</i>	<i>Qrs.</i>
"Early sown . . per rood, 22 . . or per acre	22	11
Late sown " " 19 . . or ditto	19	9½
"Weight per Winchester bushel as soon as thrashed:—		
Early sown		44½lbs.
Late sown		42½lbs.

"The crop was, as you see, very good. The land yielded potatoes the preceding year, 450 bushels per acre, and was not manured for that or the oat crop; it had before that been in grass for six or seven years. The soil a red loam. I am inclined to think that the early sowing will answer here, as this field is very high, and much exposed."

Though five bushels per acre are still a common, they are an unnecessary quantity of seed. Four bushels are amply sufficient, and when the land is in good tilth and in good condition, three bushels will be seed enough.

3. Peas.—In the neighbourhood of London it is common to sow peas so early as this on light dry soils, which have been ploughed out of some corn stubble, cleaned and manured in autumn. The land is ribbed at intervals of fifteen to eighteen inches, with a small one-horse plough—the seed, two or two and a half bushels per acre, is sown in these rows by hand, and covered in by a

broad hand-hoe, which pulls down enough of the edge of each ridgelet to cover the seed, leaving enough to be a protection from frosty winds to the young plant on first coming through, or enough to furnish a second covering with earth if the weather becomes excessively severe. This early cultivation of peas is for the early supply of Covent-garden Market with green peas. (See February.)

4. **Beans.**—The season must regulate the article of tillage in all cases, and it must suffice to say that the farmer ought to sow his beans the first month his land is dry. Winter beans are sown in autumn. But any of the common field sorts, horse or tick bean, Heligoland, long pod, mazagan, &c., may be sown in open weather in January and February. Their cultivation is given in detail in the months of February and October.

V.—PASTURES AND MEADOWS.

1. **The Pastures** may, if dry, be thinly stocked with the ewe flock, which will eat down all last year's growth, and so insure the quality of next year's grass; or they may with great advantage be folded over with either a breeding or a fattening flock, fed on turnips and hay-chaff, &c., brought to them. If wet, the feeding bare should have been effected with cattle in the autumn; no sheep being then allowed on them, nor any other stock in winter to poach the surface of the land. It is, however, wonderful to see on some poor light soils how the pastures may be trodden to pieces in winter time with cattle foddered on them, and come out all the better and the greener for the rough treatment in the following spring.

When hard with frost, manure may be carried out to pastures which have been already eaten bare; also, as already said, on the young clover, and spread. The first rains will, on all drained lands, wash the soluble parts of the dung into the roots of the grass, and thus provide them with food at the time when returning warmth is exciting them to life again.

2. **Water Meadows** are flooded during January, taking intervals of a day or two after every eight to ten days of flood, for the water to drain off and aerate the soil.

The practical rule is to flood or "float" until a scum appears upon the surface, and to avoid floating over ice if the frost should be severe enough to bind the land up in spite of the flowing water. Of the ordinary methods of irrigation, a description will be given in November, when the process is commenced. I give, however, here a short description of the simple catch-meadow, which has been found of so much advantage in wet, hilly pastures. The fol-

lowing is an account of the practice of Mr. Bickford, of Crediton, abridged from Sir S. H. Northcote's description of it in the third volume of the *Journal* of the Bath and West of England Agricultural Society.

The Bickford System of Irrigation.—A carriage-gutter is in the first place cut in the usual manner along the line of the highest ground, either catching whatever spring water flows downwards across its course, or being fed directly from a stream. The inclination of this gutter should, if possible, be such as to give a fall of about one in 400 ; but a much less rapid fall will answer the purpose. The gutter should be about one foot wide, and six inches deep. These dimensions should be gradually contracted as the gutter approaches its termination, so that it may at last die into the ground. Below this carriage-gutter, and in the same direction with it, are cut other and smaller gutters, which are perfectly level from end to end, and which successively catch the water as it trickles over the land immediately above them, collect it, and, when they are full, begin to overflow at all points at once, and so to distribute it evenly over the next section. In laying out these gutters the use of the spirit-level is superseded by a very simple and convenient instrument. It is composed of three pieces of wood, put together in the form of the letter A, standing about five feet high, and having a span of about four feet at the bottom. A plumb-line is suspended from the top, and a notch is made in the centre of the cross-piece, so that when the two feet stand on the same level the line crosses the notch. The gutterer rests one of the feet upon the ground, and, using this as a pivot, turns the whole round like a pair of compasses till he finds by the plumb-line that the two feet stand even ; he then marks the spot where the first foot stood, and, using the other foot as the pivot, finds the next level spot in the same manner, and so proceeds with great rapidity to trace out a level line through the field, marking each spot as he goes on. When this is accomplished, he takes the gutter-plough, a horse-drawn implement, which cuts and throws out a furrow slice, about four inches wide, and three or four inches deep, along the line of the marks, thus producing a small level gutter, quite as large as is necessary for catching and distributing the water, but not large enough to be an annoyance to the occupier of the land by upsetting his hay-carts, or serving as a pit-fall for his lambs.

The old-fashioned gutters, besides being open to these objections, absorb a large quantity of water, rendering it difficult to irrigate with a small stream, retaining a considerable proportion of the wealth of the water in the shape of a deposit of sediment at the bottom, and promoting the growth of coarse, sedgy grasses along their margin. They are, moreover, more expensive both to cut in

the first instance, and to clean out in each succeeding year, than the small Bickford gutters, which are rapidly and easily cut with the plough every year, and therefore require no cleaning.

The expense of cutting the fresh gutters, the level having once been ascertained, does not amount to more than 1s. an acre; whereas the cleaning out of old gutters with the ordinary tools costs at least 2s.

The expense of laying out a water-meadow on Mr. Bickford's principles may be reckoned on the average at about 1l. an acre. Looking to the great benefit conferred upon the land by the process, the cost must be regarded as wholly insignificant. In many cases the whole outlay may be recovered in a single year.

To this it is only necessary to add, in the words of the same writer elsewhere, that according to the explanation given above, it will appear that the field is watered in stages, and were the system always followed in the manner described, the upper stage would always receive the benefit of the greatest amount of sediment when the water is foul from rains: the second stage would be the next in favour, and so on, till the lowest part of the field received nothing but water in an almost filtered state. This disadvantage is obviated by the use of feeders, or small transverse gutters, which run from the carriage-gutter at the top across all the level gutters to the lowest of all. By stops at the proper places, the water can thus be conveyed directly from the carrier to any one of the catch gutters without passing over the intervening land at all, and the lowest portion of the field may be watered first, and the highest last, if desired.

VI.—THRESHING CORN.

Threshing Corn for Market—proceeds during January, as straw is needed for fodder or for litter, and as the state of the market seems to make desirable. The flail is still employed in many English barns for threshing barley, but it might as well be finally abandoned, for our threshing machines are able to turn out a perfectly good malting sample, unbroken, awnless, clean. And at the Canterbury trials of threshing machines the barley threshing was better work than that of any other grain. It is by the moveable steam-engine and threshing machine, turned out in immense numbers by all our implement makers, that the great bulk of corn in this country is now threshed. The cost of the process may be estimated as follows :—*

* The estimate which follows is that which has been given by the editor in his "Handbook of Farm Labour," lately published by Longmans.

	£	s.	d.	£	s.	d.
Hire of 8-horse-engine and machine, with engineer and feeder				1	15	0
Cost of coals, say	0	8	0			
„ water (one man and horse half his time)	0	2	6			
				0	10	6
2 men and 2 lads unloading rick, and pitching to feeder, and opening sheaves	0	6	0			
1 man attending to sacks	0	2	0			
1 man and horse removing corn . . .	0	5	0			
Labour of removing straw and chaff, and building the former, equal to 6 men	0	12	0			
				1	5	0
				3	10	6

For this sum from forty up to even sixty quarters, according to the yield, may be threshed for 1s. 6d. to 2s. a quarter.

In the case of the fixed engine the charge for power may be put at about 1l. a day for an 8-horse engine; forty quarters being easily threshed per day. The cost of labour being:—

	£	s.	d.
4 men, 2 boys, 2 women, and 3 horses to deliver the opened sheaves to the feeders from the corn stack	1	0	0
1 feeder	0	2	6
3 women and 2 men to remove the straw and build it in the straw house	0	7	0
2 men to attend to the removal of the grain to the granary	0	4	0
Labour	1	13	6
Power	1	0	0

Total cost, about 2 13 6
or less than 1s. 6d. per quarter.

In both of these cases there would be an extra charge of five or six shillings for beer or cider for the labourers.

Sometimes machines and engines are let out at so much a quarter; and a common charge is 1s. 4d. a quarter for wheat, and 10d. for oats or barley, or 3d. more when Hayes's Elevator is used for removing the straw. In either case two men (the feeder and the engineer) are included in the hire. The additional hands required are for supply of water and removal of grain, also for bringing the sheaves to the feeder, just as in the first case quoted—costing therefore 13s.; and besides these, two men will be needed to build from the straw

elevator, and this, with the beer supplied, amounts to 11s. 6d., and the coals may cost 8s.; so that the additional charge is equal to 32s. 6d., or 9d. a quarter upon a probable day's work, making the cost on the whole rather more under this plan than when a fixed charge, generally, as I have said, of 35s. a day is made for the use of the engine.

Threshing is done sometimes by the acre—5s. an acre being about the price given for the use of machine and engine, with engineer and feeder, when the whole crop (wheat, barley, oats, and beans) is let together.

The threshing of grain by machine in cases of ordinary yield may thus be put at $2\frac{1}{2}$ d. to 3d. per bushel for wheat; while it is less in the case of those crops which yield more grain to a given bulk of straw. The immense superiority of machine and steam-power threshing over hand labour consists not so much in the diminished cost per bushel as in the greater quickness of the process; and the ability thus at once to supply the market without materially interfering with the ordinary labour of the farm, and without exposing the labourers to a constant temptation to dishonesty. An extra winnowing is almost always required, and it may be done as fast as two men can measure up and sack and wheel away the sacks: two men can winnow probably sixty or seventy quarters a day, and four men, whose wages are 8s., will thus measure up at the rate of $1\frac{1}{2}$ d. to 2d. a quarter. If the wheat needs "reeing" in order to get the chaffy grain and weeds out of it, this will require a man's wages for every eight or ten quarters a day, according to the filth to be removed—and it may thus cost 2d. or more per quarter in addition to the winnowing.

Chaff-cutting.—There has been a prejudice in favour of fresh straw as fodder; and grain has thus been threshed by hand for the daily supply of cattle in the yard. It is now, however, the custom in some districts to store away several months' supply of cut chaff at a time, and however stale it thus might be supposed to be, the cattle relish it when mixed with pulped roots or scalded with some hot water in which a little salt has been put. The following is the account given by Mr. Samuel Jonas, of Ickleton, Cambridgeshire, of his experience. He says,* writing in July :—

"I have purchased of Mr. Maynard, of Whittlesford, one of his powerful chaff-cutters, with sifting apparatus attached, which cutter I can work from a wheel or drum attached to my threshing machine, which is driven by a nine-horse-power steam-engine, at the same time that I am threshing corn. The straw, when delivered from the threshing machine, is carried up an inclined plane by spiked rollers to a height of about nine feet; it then comes down an inclined

* Journal of the Royal Agricultural Society of England.

rack, nearly yelmed and ready for cutting into chaff. Three men yelm the straw, mixing with it a small quantity of green fodder, such as rye or tares. When cut into chaff, it is sifted and carried into an empty barn or chaff-house and well trodden down, and about one bushel of salt mixed with a ton of chaff, so as to cause a fermentation. All this is effected with no more manual labour than would be required to take away the straw and stack it in the ordinary manner. Within the last few days I have threshed and dressed the corn, and at the same time cut the straw into chaff from the produce of about eighty acres of wheat, at a cost, too, not exceeding 45s., or 7d. per acre for cutting the straw produced on an acre of wheat. This chaff I shall not use until next October, when I purchase my beasts for winter grazing, and none but those who have tried this plan of old chaff so managed, as compared with fresh-cut chaff, can believe the advantage in value of the old chaff for feeding stock. I can work off the produce of about eight acres of good strong wheat per day, thus cutting about eight hundred fans (ten tons) per day, the chaff being cut shorter and better than by the hand-box.

“Three men yelm the straw and feed the chaff-cutter, and if the threshing machine be placed near the barn or chaff-house which is to be filled, two men can carry the chaff into the barn; two or three boys should tread it down close, so as to cause it to heat. The only extra expense is for from four to five cwt. of coals per day. If, however, the straw is stacked as threshed and cut into chaff afterwards, the expense of cutting and sifting with Maynard’s chaff-cutter would be as follows:—

1 man to move the straw from stack to men	£	s.	d.
to yelm	0	2	0
4 men to yelm straw	0	8	0
2 men to carry away chaff	0	4	0
3 lads to tread chaff down, 6d.	0	1	6
Hire of engine and chaff-cutter (this includes			
1 man to feed chaff-cutter and engine-man)	1	10	0
Coals, 5 cwt.	0	4	6
Water, carting	0	2	0
	£2	12	0

“This will cut from 600 fans to 900 fans per day, according to the lengths of cut: the first cut being about 3-16ths of an inch in length, the latter about 3-8ths. The cost would be, the very short cut 1d. per fan; the latter cost 1-3rd of a penny per fan; but, by cutting the chaff at the same time you thresh, you save 47s. per day, or, in fact, cut 800 fans for 4s. 6d.”

This practice will introduce a great economy on many farms in

more ways than one. It will, for instance, put a stop to the tedious labour of the flail with all its constant premium on dishonesty.

VII.—THE FEEDING HOUSE AND BYRE.

The Economy of Winter Cattle-feeding—will be discussed in November and December, when it commences, and it must suffice here to refer to the continued use of the mixed chaff, pulped roots, and meal—becoming richer as the fattening process is prolonged. One half the quantity of roots formerly commonly given (or, say $\frac{3}{4}$ cwt. daily), is thus used along with 20 lbs. or more of sweet straw chaff, and 4 lbs. to 8 lbs. of meal, either beans and barley meal, or oil cake crushed and moistened, or their equivalent in carob pods or cotton seed cake, or some of the other cakes whose merits will be compared in the Calendar for November.

Cattle in Store Condition—may be kept in a healthy, and, if young, in a growing state, on a few turnips or mangold wurzels daily in yards, and fresh straw in their cribs, and a meal twice a day, consisting of a bushel of straw chaff, over which a hot and somewhat salt, thin, linseed mucilage has been thrown. One or two pounds of linseed meal and a small handful of salt to every gallon of water may be thus boiled in a copper, and thrown over two bushels of chaff, and given at twice during the day.

Certainly the practice of feeding cows in calf up till calving on straw alone, cannot be too much reprobated: the food is very insufficient, and lets them down so much in flesh, that when they calve, and are expected to yield productively, they lose a considerable time, and that, perhaps, the most valuable, in getting again into flesh before they give their usual quantity of milk; but if they have been well and sufficiently wintered, they yield at once adequately. For young cattle, it is still worse management; for their growth is stunted, and they never recover it. In so far as regards the quality of the farm-yard dung, all this reasoning becomes still more forcible; for from straw-fed cattle the farmer will, at the end of winter, find perhaps a large heap, of so poor a quality, that it will go but a little way in manuring his fields; whereas one load of dung made by fat or well-fed cattle will be equal to two or three of it.

The proper food for cows in this month is cut chaff, one half hay and the other half straw, with a good bait of turnips or cabbages. Or, if green food and hay be scarce, less of them, with straw chaff soaked in thin linseed mucilage, as already said, may be substituted. For young cattle, the same chaff, and as much cabbage or turnips or mangold wurzels as they require.

The Cow-byre.—Cows may, some of them, calve this month. If they have been receiving fodder in the straw-yard, as just stated, they

will be in good condition for calving. They should afterwards receive more succulent food than formerly—as turnips, cabbages, mangold wurzels. After they calve, they should be kept quite from the other lean stock, either in the house or in another yard, and be fed upon those articles and hay, or cut chaff, mixed with pulped roots, and two or three pounds of meal, daily. Cabbages, of which forty or fifty tons may be grown per acre will maintain cows in the cheapest manner; and the butter made from their milk will be perfectly sweet, whatever (almost) be their food, if the milk have hot water (one pint to a gallon) added, when set for cream, and if the cream be scalded—the tin of cream being placed for half an hour before churning, in a boiler of water at the boiling heat, and its contents stirred repeatedly. It is, however, right, if cabbages be given, to remove all decayed and yellow leaves, giving the cows nothing but the heart of the cabbage: the refuse leaves will be eaten clean up by the lean cattle. The great expense of winter-feeding cows with hay alone eats up the profits of the dairy, even if none be given till they calve; for supposing them to calve in January or February, there remain three or four months for that expensive food.

In estimating the cost, it is not necessary to consider whether it will answer to give hay to them when at certain high prices, as many farmers are, by their leases, deprived of the power of selling hay. Where this is the case, the hay must be valued at what it costs, and not at what it would sell for. This estimate is easily made: and it will be found on calculation, that it can hardly be valued at less than 3*l.* a ton.

Supposing a cow to be fed at the rate of 56lbs. per diem during 120 days, she will consume exactly three tons, which at 60*s.* is 9*l.*, and no other calculation is necessary, to prove that feeding cows with hay is ruinous. I have fed cows with my own hands, that have eaten more than 56lbs. per diem; but supposing only 30lbs. per diem, four months' food will be above one ton and a half, costing near 5*l.*, which is much too high, and ought to convince the young farmer how necessary it is for him to provide green winter food.

It is found that cows fed on pulped turnips or mangolds, one cwt. apiece, mixed with fifteen or twenty pounds of straw chaff, and two or three pounds of beanmeal, give butter without any disagreeable taste. And this is a much more economical food than hay.

Calves.—In the weaning of the calf there are many methods. One as good as any is to let it suck for a week or ten days, feeding afterwards from the bucket with new milk for another week, till it can drink easily, giving it three quarts at morning, and as much at evening. Afterwards, for the new milk skim milk is gradually substituted, and half a pint of good oatmeal for each meal per calf is mixed with hot water for some hours before it is added to the allowance of skim milk which each calf receives. When many

calves are thus fed, the oatmeal and water are in quantity enough, if boiling in the morning, to keep warm till night, and one quart of this warm mucilage may then be mixed with three quarts of skim milk for each meal per calf. Linseed, similarly prepared, may be substituted for the oatmeal.

It is proper to add, that when calves are brought up by hand to be afterwards reared and fattened as beef, they should receive new milk constantly; the quantity being gradually diminished by the substitution of dry food, with access to water. Oil cake may be given to them, a piece to suck being put in their mouths after drinking their milk, so that they are easily accustomed to the taste of it; and a netfull of sweet hay should hang up within their reach. Of their further treatment more will be said hereafter; and on the management of the dairy, remarks will fall more properly in April and May: for the present it must suffice to say that the milk will throw up cream more readily and more abundantly if kept in a warm room, or even, as Mr. Horsfall, of Otley, has found, if it be placed in trays to stand in warm water continually running by them.

Young Cattle.—The last year's calves should now be fed liberally with chaff of hay and straw, mixed with pulped roots, either turnips or mangolds; and they should be thoroughly well fed, and kept perfectly clean by means of litter. At this age it is a matter of great consequence to keep such young cattle as well as possible, for the contrary practice will inevitably stop their growth, which cannot be recovered by the best summer food. To steers and heifers two years old, the same food in proportionate quantity may be given, the chaff being of hay, if it is abundant; or straw, with baits of turnips, cabbages, &c. It is not right to keep yearling calves and two-year olds together; they should, if in yards, be sorted out in lots of equal size and strength, or the weak ones suffer. And if the practice of giving them out turnips along with a little hay or access to the straw, should be adopted, yearlings should receive in addition one or two pounds of oil cake daily apiece. The two-year-old steers should be in fattening order on the best food of the feeding house, as already described—or, if heifers, on the less fattening diet, to which reference has already been made.

VIII.—THE SHEEPFOLD.

The Breeding Flock.—In this month ewes of some breeds of sheep will lamb. They should be provided with shelter, food, and attendance. They seldom need turnips till near the end of the year; most farmers having grass sufficient for the ewe flock till they are near lambing, when they should have turnips regularly given them. If the land be not dry, the best method is to draw the turnips, and

cart them to a dry pasture, and there bait the sheep on them twice a day, observing well that they eat clean, and make no waste; which is not a bad rule for ascertaining the quantity necessary. In this way the turnip crop goes the farthest. On dry soils, the best way, as the best manuring for the succeeding barley crop, is to eat the crop on the land, hurdling off a certain quantity for the flock; and, as fast as the crop is consumed, whether off the land or cut in troughs, to remove the hurdles farther. This method saves much trouble, and is highly improving to the land; but it should be practised only on lands that are dry, otherwise the sheep poach, and do mischief. The crop, when eaten as it stands, will not go so far as if drawn and laid in a grass field; for the sheep dung, and stale, and trample on many of the roots after they are begun, which occasions waste: nor is there any loss of manure in carting them, only it is left, in one instance, on the arable field, and, in the other, on the grass one. No improvement can be greater than this of feeding the sheep with turnips. On whatever land they are given, the benefit is always very great.

In wet weather, storms, or snows, the sheep and lambs should be baited on hay, receiving, in moveable racks, a certain quantity every day. And they are the better for a small quantity of hay daily while on turnips, let the weather be good or bad. In some parts, ewes and lambs this month receive bran, malt dust, oats, or oil cake, in troughs, while they are feeding on turnips. And it has been found capital feeding for them when pulped roots, mixed with straw chaff, has been given them in troughs instead of turnips merely cut or turnips eaten off the land. Take the case of Mr. MacLagan's flock,* described by him as follows:—

“Disapproving of giving them a full supply of turnips, and grudging the expense of feeding them on hay, for which I generally get about 3*l.* per ton, and having always failed in my attempts to make them eat straw, I determined to try the root-pulping system with them. There is generally sufficient grass in my pastures for them till the middle of December. Whenever the grass becomes scanty, I commence to give them pulped turnips and chaff, at the rate of 10*lbs.* of turnips to each ewe per day. This is gradually increased to 15*lbs.*, more than which they seldom get till they are lambed, when they are allowed 20*lbs.* and upwards, or, in fact, as much as they can consume. About three weeks before lambing, I mix with the pulped turnips and chaff brewer's grains, beanmeal, crushed oats, or some other extra food, to bring the milk upon them, and the same feeding is continued after they have lambed till there is a full bite of grass for them. I also allow them a limited quantity of hay some weeks before they lamb, as my object is to

* Mr. MacLagan of Pumpherstone, Linlithgowshire:—*Journal of the Agricultural Society.*

have my lambs fat and ready for the market as early as possible."

In severe weather it is right to provide ample shelter, its nature depending on the size, character, and convenience of the farm. The following remarks on this subject are by Mr. Spooner, of Southampton, in a late volume of the *Agricultural Gazette* :—

"For shelter, a large covered shed, fitted with rack and manger for hay and roots, closed on one side, but, with the exception of hurdles, open on the other, will be the most convenient building; and close adjoining there should be a hovel protected on all sides, for the purpose of receiving ewes with weakly lambs, or, in severe weather, to accommodate the lambs as fast as they fall, until they get a little strength. The sheds will, of course, open into the lambing-yard, which should be situated as near as possible to the shepherd's cottage. The yard should face to the south, and should be well bedded with earth, and then littered up with straw, so as to insure cleanliness and afford warmth and comfort to ewes. In the absence of any permanent building, considerable shelter can be afforded in the open field by means of thatched hurdles, to break the force of the prevalent wind (more particularly the east), and also overhead, to keep out the rain or snow. It would also answer well on farms where large flocks are kept to have moveable lambing-houses, such as can be readily taken to pieces and erected again without much trouble.

"Of course, if the flocks are kept in the field, either a hut or a house on wheels will be provided for the shepherd, so that he may not only have shelter for himself, but a fire likewise, with the aid of which he can warm gruel for an exhausted ewe, or prepare any convenient remedy that may be required. The ewes should be visited from time to time during the night, so as to afford assistance when really required, but not to do so officiously; for although in many cases lambs are lost for the want of assistance, yet in others, the ewes are sometimes destroyed by unnecessary interference. One rule of importance should be borne in mind, which is, that manual assistance should be rendered to assist, and not to control or oppose the efforts of nature. When, therefore, some degree of force is used in removing the lamb, it should be rendered during the labour pains, and it is often needful to wait for their recurrence. The cases most frequently requiring assistance are those where the presentation of the lamb is unfavourable, and where the lamb is dead. The ordinary presentation, it is well known, is with the fore-feet first, and the head next, resting on the fore legs—the parts thus presenting themselves in the form of a wedge. Sometimes the head, and at others the legs are bent back, or the fore feet may be coming together, or the lamb may lie on its back. These are false presentations, and the object should be by means of a small hand

and skilful manipulation to turn the lamb, or push back or bring forward the parts that are misplaced. In some cases this cannot be done without destroying the lamb, but it is much preferable to lose the lamb than the ewe. Sometimes the hind parts present first, and then the labour is difficult. With regard to medicine, the following may be given in difficult cases, more particularly when there is much exhaustion :—Opium powdered, 4 drachms ; spirit of nitrous ether, 6 ounces ; water, 2 ounces. Mix. To be well shaken, and a teaspoonful given as a dose with gruel, in which there has been previously mixed a teaspoonful of the following powder :—Ginger, 2 ounces ; gentian, 2 ounces ; cascarilla bark, 2 ounces. Mix. When there is much fever the latter may be omitted.

“Puerperal fever, or heaving after lambing, is a very dangerous disease ; indeed, the cases of death preponderate over those of recovery. Inflammatory cases, where there is little exhaustion, may be treated by a copious bleeding at first, and afterwards by sedatives and aperients ; but where there is much exhaustion all we can do is to endeavour to rally the efforts of the nervous system by giving the medicine recommended above.

“Though, as tending to abortion, the free use of turnips for heavy ewes is to be avoided before lambing, yet instances of very bad fortune have occurred where turnips had not been given, and other instances of good luck attending where turnips had not been denied. The result of many facts enables us to assign as the cause of warping and water-bellied lambs the consumption of extremely watery food. With regard to the treatment of abortion, it is a point of much importance to remove the dead lamb as soon as possible ; assistance should therefore be given the ewe at each recurrence of the labour pains, and in other respects the treatment should be the same as in parturition. 1.

“One point is also deserving of much attention, which is, that few things contribute more to the health and well-doing of ewes in lamb than by causing them to take a fair amount of exercise every day.”

Of the feeding flock, whether in house, in fold, or in field, a full account is given in the autumn months. They will be drafted off in January, as they are getting fat, and sold with their wool on.

The remarks on the management of lambing ewes so early in the year will appear out of season to the great majority of breeders whose lambing time commences in February and extends through March into April ; and there are flocks to which they are just as ill timed from being too late, for when house lamb is fattened the lambs must be dropped in November and December, and on their management remarks will be made in those months. The breed of sheep kept for this purpose is the horned Dorset, a breed peculiar to the counties of Dorsetshire and Somersetshire. The following details of their

management at this season of the year are extracted from a fuller account given in 1854 in the *Agricultural Gazette* :—

The ewes are brought to take the ram so early as May and June by feeding them upon trifolium and cut Swedes or mangold placed in troughs, giving them also a change on dry pasture for a few hours during the day ; and if necessary about half a pint of beans each per day. After the rams are removed from the flock, and the ewes are ascertained to be with lamb, it is best not to keep them too high. A dry pasture with a change to a fold of tares or similar food, would be most suitable ; and they should be managed as a store flock, the object being to keep numbers and to feed the land bare. The travelling consequent upon daily removal for change of food will also prove beneficial ; for it is admitted by all flock-masters that the ewes and their offspring will be more healthy when the former have received a moderate amount of exercise during the period of pregnancy. Even when the lambing takes place in the months of December or January, it is generally unnecessary to resort to the lambing-yard because of the comparative mildness of the weather in the counties where this practice of fattening early lamb prevails. On the other hand, it is not advisable to allow the ewes to roam at large during the night-time, as those about to yearn are too apt to stray away from the main part of the flock, and their lambs are often lost, or found dead. A shifting fold should be used, being placed on the driest and most sheltered part of the pasture field, and removed on to fresh ground every day. By this means the animals lie on clean land, which, with shelter, will contribute greatly to their health and well-doing ; and will, at the same time, enable the shepherd to attend to those ewes which may require assistance ; nor can the young lambs, when they fall, escape observation. By this mode of proceeding, the shepherd can at every visit remove all those ewes and lambs which require such care to a place of greater security ; for in heavy rain it is necessary to take them to a hovel or covered shed. When the lambs are perfectly strong, and the ewes healthy, it will not be necessary to put them under cover.

If Italian rye grass has been sown over a certain extent of wheat, then the ewes with their lambs should now be placed on the best of this in the wheat stubbles and on the young clovers, taking care to feed the clovers at the day-time, and the wheat stubbles during the night, as the former would receive damage by the stock feeding during the night frosts ; and the latter furnishes the best lair and shelter for the young lambs.

In this manner the ewes will give the greatest quantity of milk, and they may be kept upon these grasses until the lamb is a month or five weeks old with immense advantage ; for the lambs will be found at the end of that time in the best possible condition. At a

month old the ram lambs should be castrated. There are two methods pursued; one called drawing, which is done whilst the lamb is from a week to ten days old; the other called cutting and searing, which may be effected with advantage after the lamb is a month old. The latter plan, though not so commonly followed, is safer; and the lambs, when arrived at maturity, will be found much more fleshy. When the lambs have attained the above-named age, they, as well as the ewes, should be taken from the grass and placed upon root-feeding. At this age the lamb begins to require food in addition to its mother's milk; and for the benefit of the ewe it is desirable that the lamb should have it; for although the lamb would go on and improve up to the age of eight or nine weeks old without artificial aid, yet the condition of the mother would be greatly reduced. And it is customary to fat the ewe and the lamb at the same time.

Previous to commencing the feeding of roots, whether they consist of common turnips, Swedes, or carrots, they should be stacked or heaped in readiness for consumption about a week or ten days before being required for use. This will give time for the work to be kept forward should bad weather supervene, which may otherwise prevent the process of lifting the crop, and thus stop the system of feeding. The advantage of this mode of feeding depends very much upon the roots being cut and placed in troughs, both for the ewes and lambs, which has enabled farmers occupying comparatively cold and heavy land to keep this early stock. Some of our heaviest clay loams, which feed badly in the winter months, produce roots of the best quality; and with the plan of trough-feeding, these soils, under particular management, will produce the best stock, owing to the great feeding value of the roots grown upon them.

The lambs should feed in advance, and separate from the ewes; and, therefore, a lamb-gate should be provided, with space between the rounds to allow the lambs to pass through freely, without being sufficiently wide to admit the ewes.

The lambs should be fed first, as this will draw them away from the ewes, and otherwise they are apt to contract the habit of feeding with them, which is objectionable, because the ewes receive the coarser food. Feeding should commence as soon as the shepherd can see in the morning, giving hay first, both to lambs and ewes; after which, the troughs should be filled with cut roots, taking care to have them cut finest for the lambs, which is done by passing them twice through the cutter, which plan reduces the food into a state resembling dice, in which state the lambs can readily consume it, and are induced to feed at the earliest period, without loss of time and without waste. As soon as the troughs have been supplied with cut roots, then proceed to give oil-cake and peas, the quantity to be regulated by their wants, always taking care to allow them as

much as they will eat. To prevent waste, let the oil-cake be broken fine—about the size of a horse-bean is the best size—otherwise great waste will occur; for the lambs, whilst young, will take large pieces up and drop them outside the troughs, where it is trodden under foot and wasted. To induce them to eat cake or peas at first, it is sometimes necessary to mix a small portion of common salt with it. The ewes should next receive their allowance of cake, but without any peas, commencing with a quarter of a pound per day, the half of which should be given at this time, the other half just before the last bait of roots in the evening. After receiving cake for two or three weeks, the quantity may be gradually increased up to a pound per day each, taking care to feed with only half the full allowance morning and evening; and towards the end of the fattening process half a pint of beans should be given them daily. This renders their flesh more firm, the great objection to ewes fattened while suckling their lambs being, that they are mostly deficient in firmness and quality of meat. Cut roots should be given at times during the day, and the trough quite filled at night.

The lambs whilst young should have hay or hay-chaff twice a day; but after they arrive at the age of eight or nine weeks, they should receive hay three times per day; the first bait, as has been stated, the first thing in the morning, the second at noon, and the third about three o'clock in the afternoon. It will not answer much later in the day; for in the short days of winter, after the lambs have drawn away from the ewes, they will lie down for the night, and the portion of hay not consumed will, in case of rain, be distasteful to them, and damaged for further use. The lambs, however, seldom consume all the hay, nor should they be required to do so; for it is better that they select the best portions of it, the remainder being removed and given to the ewes. In feeding with oil-cake and peas, care should be taken to use covered troughs, and the last bait in the afternoon should not be given later than three o'clock, otherwise a portion may be left in the troughs, which will be damaged in case of rain, with change of wind during the night-time. Roots for the lambs should be supplied at short intervals, taking care to have any refuse remaining in the troughs removed every morning; cleanliness in feeding lambs being indispensable. The ewes may receive their oil-cake in open troughs, as they generally eat it immediately they are fed. There is then no time for it to receive damage by rain, &c.; but the troughs should be turned upside down to keep them dry during the time they are not in use.

In illustration of the fitness of these remarks to this season of the year I quote portions of letters written by a Hampshire farmer, on January 6th and January 20th.*

* I have weekly reports for several years from fifteen or twenty farms, in all quarters of the island, which are a capital guide to the seasonableness of whatever instructions may be given.

January 6th.—Our shepherds are still busy with the lambing season ; although our horned ewes finished lambing in the month of December, yet in our flock of Southdown ewes we have at least a moiety which have not lambed ; indeed, we consider ourselves warranted in saying that the Southdown ewes of the best and early lambing flocks are at least from ten to fourteen days later to lamb this year.”

“January 20th.—Our shepherds are now engaged in feeding the ewes and lambs in earnest ; the lambing season now drawing to a close, their attention is chiefly turned to fattening the lambs ; they are allowed to range over about a quarter of an acre of turnips, and eat off the tops before the ewes ; they also get plenty of cut Swedes passed twice through Gardener’s machine ; they receive also a liberal allowance of white clover hay, and as much linseed cake and cracked peas as they can eat ; for we have found, after years of experience, if you would have fat lambs in perfection, they should have plenty of trough food at all times ; nor is it less important that the ewes should be well fed, as it is proverbial with us that fat ewes make fat lambs. We have commenced selling our Somerset lambs dropped in October.”

How different sheep management is at the two ends of the island may be gathered from the account given to me of a Lammermoor sheep farm consisting of nearly 5000 acres, at an elevation of 700 to 1200 feet. The sheep stock amounts to 2000 ewes and 600 hogs, composed of 800 Cheviot and 1200 black-faced ewes with the hogs. Most of the black-faced are crossed with Leicester rams ; the rest, with the Cheviot ewes, are kept pure. The whole produce, except the ewe lambs required to keep up the stock, are sold off. The Cheviot ewes are drafted at four years old, while half of the black-faced are retained until they are five.

It being, of course, a necessary rule that the mouths should not arrive before the food, as spring growth is late on the mountains, the lambing season does not commence till the middle of April, and the tups in fact are not taken from among the ewes till the beginning or middle of December, when many Hampshire farms already have lambs six weeks old.

IX.—SWINE.

During this and the previous months the earlier litters of last spring are being fattened as bacon, and the later litters of last autumn as pork.

The fattening process is mentioned largely under other months, and I shall at present speak only of the management of sows and pigs. Each litter must be kept in a sty, and fed with dairy wash and brewer’s grains out of cisterns, and with the food stored for them

in autumn, such as mangold wurzel, carrots, cabbages ; all these do for them excellently. To substitute barley or pease, or even purchased bran or pollard, is therefore unprofitable. The sows should always have as much as they will eat, or the pigs will suffer ; and what is of as much consequence is keeping them well littered. Let them be always perfectly clean ; it insures the health of the pigs, and at the same time raises a large quantity of the best manure on a farm.

The farmer who would make a considerable profit by hogs, must determine to keep a proper number of sows, in order to breed many pigs ; but this resolution ought to be preceded by the most careful provision of crops proper for supporting this stock. The proper ones for that purpose are barley, beans, peas, clover, vetches, potatoes, mangold wurzel, carrots. In the common management, a farmer keeps only a sow or two, because his dairy will do no more ; but when crops are planted purposely for swine, a different conduct may be pursued. Mangold wurzel, carrots, Swedish turnips, and cabbages, must be provided for the sows and stores from October till the end of May, by which time tares, clover, lucerne, should be ready to receive them, which will carry them till the stubbles are cleared ; mangold wurzel will indeed be good food through the summer, so that the whole year is filled up with these plants, together with the common offal of the barn-door and the corn-fields. When the sows pig, meal must be provided to make wash, by mixing it with water. This, in summer, will be good enough for their support, and in winter it must be mixed with boiled roots, ground oats, and thinned pease meal in water, for the young pigs. If cows are kept, then the dairy-wash is to be used in the above mixtures.

In order to the highest advantage, the sows should pig but twice a year ; that is, in March and August ; by which means there will never be a long and expensive season for rearing the pigs before they are put to the staple food of clover, mangold, &c.

Upon this plan the annual sale of lean hogs should be in October, the litters of April being sold then as stores, and those of August kept till October twelvemonth, to sell for baconers, if the farmer fats none himself. The stock upon hand this month will, in that case, be the sows, and the pigs littered in the preceding August ; all which should have roots from the store, and run at the same time in the farmyard. In proportion to what they find in the straw of the barnyard, you must supply them with roots, giving enough to keep them to their growth.

It has been often remarked, that winter pigs are unprofitable ; and it is certainly true, if they are not kept with great care and attention. Where there is a dairy, the milk and whey may be so profitably applied to their use, that it should be preserved carefully for that purpose. Six pecks of peas boiled in a hogshead of water till well broken and dissolved, and then mixed in a tub or cistern with

dairy-wash, or given alone, will wean them well. If dry meat be given in addition, or alone, it should be oats, which do for young swine far better than other sorts of grain. Barley does not agree nearly so well with them.

X.—HORSES.

One of the most useful general rules that can be observed by an arable farmer is, to keep his horses always at work. The expense of a team is so great, that if he does not pursue this rule, he must lose by them. January is a month in which all business of tillage ought to be at a stop. If the weather be a hard frost, care should be taken to make use of it in carting manures on the farm. If there are composts ready, a frost should not be let slip; or, if there be faggot carting to be performed, or the earth of borders under hedges to be carried, the carts should be kept close to work of that kind, as long as the frost lasts. But in open weather, road work must be done. Carting out the corn may not nearly employ the teams; on other days, the carts should go to the nearest town for manure. There certainly are situations precluded from this advantage, but not many.

As to their food in winter, the most various practice prevails. In the following page I give a table of the weekly ration given during the winter season by a number of my correspondents, whose practice in this particular I had occasion to describe elsewhere.

In successive columns I have put, first, the number of the case; secondly, the authority on which it is given; thirdly, the weight consumed per week of hay, oats, beans, roots, clovers, and straw by a horse; and lastly, the calculated weekly cost of so maintaining it. This cost is calculated at the rates of 3*s.* a cwt. for hay, 3*s.* a bushel for oats, 5*s.* a bushel for beans, 4*d.* a cwt. for turnips or mangold-wurzel, 6*d.* a cwt. for carrots and clover, and without charge for straw. Where an *asterisk* (*) is attached to any item, it is to be understood that the corn has been bruised or ground, or the hay or straw has been cut into chaff; where a *dagger* (†) is appended, the article so marked has been boiled or steamed; a mark of interrogation (?) indicates that the result so marked is uncertain, owing to some indefiniteness in the account given. The prices adopted in calculating the cost of food are the market prices of the *grain* consumed; and in the cases of the *hay* and *green food*, the value which it is supposed they might produce if given to other kinds of live stock on the farm.

XI.—FENCES.

This is the principal season for hedging and ditching. A farmer cannot give too much attention to the fences of his farm; for, with-

THE WEEKLY FOOD OF A FARM HORSE IN WINTER.

No.	Name and Address.	Hay.	Oats.	Beans.	Roots.	Sundries.	Straw.	Weekly Cost.
		lbs.	lbs.	lbs.	Potatoes. Turnips.	lbs. Potatoes. Barley.	lbs. ad lib.	s. d.
1	Professor Low—Elements of Agriculture	56*	56*	.....	56†	.....	56*	6 6
2	H. Stephens—Book of the Farm.....	112	35	.....	112	.....	.....	6 0
3	J. Gibson, Woolmet—H. Soc. 1850 .....	.....	84	.....	217†	217†	112	9 0
4	— Binnie, Seaton .....	.....	70*	28*	243†	42†	ad lib.	11 6
5	— Thomson, Hangingside .....	.....	84	14	336	14	ad lib.	9 6
6	W. C. Spooner, Ag. Soc. Journ., vol. ix.	.....	63	.....	42	.....	196	4 9
7	T. Aitken, Spalding, Lincolnshire	ad lib. (3)	37	35	.....	.....	ad lib. (3)	9 0
8	G. W. Baker, Woburn, Bedfordshire.....	.....	60*	20*	.....	.....	.....	9 8
9	R. Baker, Writtle, Essex	70	42	.....	.....	.....	140	5 0
10	J. Coleman, Cirencester .....	.....	84	16	.....	.....	ad lib.	7 3
11	T. P. Dods, Hexham.....	.....	95	.....	56	.....	ad lib.	8 0
12	J. Cobban, Whitfield.....	84*	60*	.....	.....	Linseed. 3½	ad lib.*	7 3
13	S. Druce, jun., Ensham	112	52	.....	Swedes. 70	.....	2 bu.*	7 0
14	C. Howard, Biddenham	ad lib. (3)	52	17	84	.....	ad lib.*	8 6?
15	I. J. Mechi, Tiptree.....	49*	70*	.....	M. wurzel. 210	.....	ad lib.*	7 6
16	W. J. Pope, Bridport	2*	84	.....	.....	.....	ad lib.	9 0?
17	S. Rich, Didmorton, Gloucestershire	168	63	.....	.....	Grains. 2 bu.	ad lib.	10 8
18	H. E. Sadler, Lavant, Sussex.....	140	84	.....	.....	.....	.....	9 9
19	J. Morton, Whitfield Farm .....	.....	126	.....	Carrots. 350	.....	ad lib.	10 9
20	E. H. Sandford, Dover.....	56	42	.....	.....	Bran. 12	ad lib.	5 6
21	A. Simpson, Beaulieu, N. B.....	.....	49	7	105	Tail Corn. 21	ad lib.*	5 6
22	H. J. Wilson, Mansfield	42	52½	.....	.....	Bran. 21	ad lib.	6 6?
23	F. Sowerby, Aylesby, N. Lincolnshire...	112	28	.....	Cut Oat Sheaf.	.....	ad lib.*	8 0?

out good ones, he might as well cultivate open fields: he cannot manage his land as he pleases, but is for ever cramped, for fear that his own or other people's cattle should break into his corn or hay-fields. In plashing (pleaching) a hedge, the men first clear the old hedge

of all the dead wood, brambles, and other irregularly-growing rubbish, leaving along the top of the bank the straightest and best-growing stems of thorns, hazel, elm, oak, ash, willow, beech, &c., about five or six in a yard; but if there are any gaps or places thin of live wood, on each side of such places they leave the more. When this work is done, they repair the ditch, which I should never advise to be less than three feet by two and a half, and six inches wide at bottom in the driest soils; but in all wet or moist ones, never less than four by three, and one at bottom. All the earth that arises from the ditch is to be thrown on the bank. The men, if no bargain is made with them beforehand, will lay some of it on the brow of the ditch; but this must not be allowed, unless the ditch earth happens to be extraordinarily rich, and to pay well for carrying it to the land, otherwise the grass of the border is spoiled, and the farmer is at the expense of carting earth which may be worth but little. When the ditch is finished, the men begin the hedge. Such of the stems left in cutting the old hedge as they find growing in the line where the new hedge is to run, they cut off three feet from the top of the bank, to serve as hedge-stakes to the new hedge. These stakes being immovable, and never rotting, keep up the new hedge, so that it never falls, or leans either way. In the next place, they drive in their dead hedge-stakes where wanted. The hedgers then plash down the remainder of the live wood left standing. They cut the stick twice, one stroke near the ground, and the other about ten or twelve inches higher, and just deep enough to slit out a part of the wood between the two, leaving the stem supported by little more than a quarter of its first size. It is then laid along the top of the bank and weaved among the hedge-stakes. All are served thus; and, where they are not thick enough to finish the hedge, dead thorns are wove among them; then the top of the hedge is "eddered" in the common manner.

The fence thus made consists of a good ditch and a hedge most parts of which are alive; that is, the stakes and much of the wood woven between them. This management insures a lasting fence; whereas the hedges that are all dead, presently rot and fall into the ditch. Those farmers who live in counties that know nothing of the plashing method, cannot give too much attention to teaching it to their men. The best way is, to send for a labourer from Warwickshire, who, in one season, will easily instruct their regular men in the business, which they may afterwards perform without difficulty. —The above instructions are left nearly as they were revised by the author thirty or forty years ago; but it is right to add that the use of hedge-side ditches on well-drained lands is now becoming obsolete, and thorns, like other plants, grow best on land through which on both sides of them they can send their roots. A young fence protected otherwise than by a ditch on one side of it when

young grows better on well-drained land than one planted on the top of a bank and ditch, and when strong enough to serve its purpose, it is to be kept in form by a proper annual pruning, which will dispense with the need of pleaching so as to cover blanks and reduce irregular growth.

XII.—WOODLAND.

This month is generally a busy one in felling copse: the men who do the work are commonly paid by measure, or tale. In some districts the falls are only cut and laid in rows, and sold in that manner by the rood; in others, the farmer converts the stuff to its proper use, and sorts it into faggots, poles, hoop-stuff, or hurdles: and this, I believe, will generally prove the most profitable way.

In cutting woods there is one point much disputed, which is, the number of years' growth at which to cut. Customs vary from nine years to twenty-seven, but generally about twelve or fourteen. I have seen many woods, in cutting which one stem on a stool was left, to be of a double age at next cutting, in order to have some large wood in each fall. The question is, whether such stems draw from the root so much nourishment as to lessen the young growth as much as the large shoots amount to? From viewing such woods, I have observed, that the part of twelve years' growth, among which were some stems twenty-four years old, was as good as others, where the whole was only twelve. If so, the additional growth is nearly all profit; but if not, it certainly makes the wood when cut more saleable, and applicable to more purposes.

In the beech woods of Buckinghamshire, this system has been carried exceedingly far; for they are not cut till of thirty or forty years' growth; the consequence of which is, they are destroyed as underwood, and nothing appears but single stems, which are successions of young trees. The way of cutting them is not by falls, as in common woods, but by singling out, every year, the largest of the trees, and cutting enough of them to pay 12s., 15s., or 20s per acre, per annum, according to the goodness of the wood. These trees, though some of them when cut would more than measure as timber, are all sawn into lengths of four feet, or thereabouts, and rived into billets for fire-wood, for the London market, being conveyed there by the Thames. Good beech woods, upon this system, will pay 20s. an acre, clear of expenses, which is more than underwood would pay upon the same soil. I believe it will generally be found, that the older the growth, the greater will be the profit. At twelve years' growth of ash, the land must be very good to have a crop of hop-poles; but at twenty years' growth, you will have very fine ones, and pay yourself much better than by the younger growth.

Some woods are so very wet that the ash, hazel, hornbeam, and

oak stubs will not thrive ; in that case, the sallow and willow should be multiplied, or the wood drained, which is a practice coming into more general use in hop-pole and other plantations.

Lest February should prove a forward month, ash timber had better be felled in January than delayed longer : this is upon the supposition that the farmer occupies his own land, and employs a wheelwright constantly, which I have found to be a cheaper plan than employing others in the common way. If elm abounds on the farm, this is the season to fell that also.

Planting may be carried on and should be finished during this month. Whatever pruning deciduous timber trees require should be completed in January.

Osiers may be cut in January. The planting of new beds may also be done this month. The sets are simply two or three feet cuts of wood of two or three years' growth, pushed right side down ten or twelve inches deep in any river-side land deeply dug in autumn, in which they are planted, in yard-wide rows, and at intervals of a couple of feet.

Hop grounds give work this month in throwing and sorting the poles, in cutting underwood and pole plantations, occasionally in trenching operations, and in the preparation of manure.

Orchards should be pruned in December and January, and preparations may soon be made for grafting by cutting back the line to be grafted, and by cutting grafts which may be stuck in a damp and shaded border until required for use.

FEBRUARY.

The ordinary weather of this month is described by the figures in the meteorological table on next page, which are descriptive of the temperature and rainfall of a number of English stations. February is more variable from year to year than any other month. Sometimes an early spring time, and in other years "February fill dyke," it is the ficklest of the twelve.

Besides the ordinary operations of the farm, other subjects may properly engage the attention of the farmer in early spring time. Thus, (1) *the Relations of Landlord and Tenant* deserve his study before the Lady-day period of entry ; for if he be not now in the occupation of a farm, he is no doubt seeking one.—(2) *The Erection of Farm Buildings*, for which plans have been matured and materials have been gathered during the winter months, may be commenced as soon as possible after the frost has left us.

THE WEATHER OF FEBRUARY.

LOCALITY.	AUTHORITY.	Mean tempe- rature.	Lowest mean tempe- rature.	Highest mean tempe- rature.	Greatest heat.	Lowest maxi- mum heat.	Highest mini- mum cold.	Greatest cold.	Average amount of rain. inches.	Smallest amount of rain. inches.	Greatest amount of rain. inches.	Average number of rainy days.	Smallest number of rainy days.	Greatest number of rainy days.	No. of years' obser- vations.
Guernsey.....	Dr. Hoskins, F.R.S.	41.9	36.5	46.4	54.5	45.5	40.0	27.0	1.9	0.5	3.3	12	6	20	13
Helston	Mr. M. P. Moyle ...	44.3	36.8	47.3	62.0	53.0	36.0	19.0	2.5	1.1	7.4	14	9	29	13
Exeter	Mr. W. H. Ellis.....	41.0	32.3	46.3	60.5	52.6	32.0	17.0	2.1	0.4	4.3	15	10	20	13
Ventnor, Isle of Wight	Dr. Martin	40.7	33.7	45.8	58.0	49.0	34.0	21.0	1.2	0.3	2.6	11	7	15	9
Worthing, Sussex Clifton near Bristol	Dr. Barker	39.4	30.8	43.4	52.5	44.2	32.5	18.0	1.1	0.2	2.5	11	7	18	8
London Royal Observatory	Mr. W. C. Burder ...	37.4	29.3	42.9	55.5	45.7	28.6	11.5	1.3	0.7	1.9	13	10	18	8
Oxford	{ The Astronomer Royal	39.7	29.4	44.7	59.0	45.0	30.7	11.1	1.3	0.2	2.6	11	3	19	14
Bedford	Rev. R. Maine	38.6	29.2	44.0	56.6	42.0	29.5	7.5	1.1	0.3	1.8	9	6	15	12
Lampeter, near Cardigan	Dr. Barker	38.1	29.2	43.6	59.5	40.0	30.0	7.5	1.0	0.3	1.6	11	6	17	10
Norwich	Professor Matthews	38.1	30.4	42.9	57.8	47.4	27.6	9.0	2.4	0.6	3.7	15	9	20	6
Highfield-House Observatory..}	Mr. W. Brooke	38.8	32.5	43.4	56.5	44.0	29.0	13.0	1.7	0.1	4.2	13	5	21	13
Hawarden, Chester Manchester.....	Mr. E. J. Lowe.....	38.6	28.4	43.5	61.0	39.7	27.4	6.1	1.4	0.3	3.6	14	4	24	14*
Leeds	Dr. Moffat	39.0	29.7	45.0	57.0	42.0	31.0	14.0	1.4	0.4	2.9	8	2	15	11
York	Mr. G. V. Vernon...	37.8	28.7	44.1	57.0	48.5	28.0	7.5	1.9	0.3	3.9	14	7	20	11
Scarborough	Mr. H. Denny	38.4	30.3	42.7	57.0	43.0	29.0	9.0	0.9	0.3	1.5	9	6	16	9
Isle of Man.....	Mr. Ford.....	37.1	26.5	41.0	54.0	36.0	29.0	1.5	1.3	0.4	4.2	11	5	24	13
Durham	Mr. B. Cooke	37.5	31.0	41.1	53.0	38.0	30.5	16.5	1.1	0.4	2.5	8	3	14	6
North Shields	Mr. J. Burman	39.7	32.1	43.2	53.8	42.7	30.6	16.0	2.1	0.9	3.6	14	7	20	7
Silloth	Mr. J. Marth.....	38.9	31.4	42.5	57.8	40.4	28.4	17.1	1.3	0.0	4.3	9	2	15	9
	Mr. R. Spencer	37.6	32.1	43.5	57.0	39.8	31.0	7.0	1.9	0.8	4.4	16	8	25	11
	Rev. T. Bedford.....	39.2	32.5	42.8	55.2	49.5	26.7	11.7	1.5	0.2	2.8	—	—	—	6

* Observations on temperature at Highfield House for last fifty years.

Besides these, the ordinary field work may include the sowing of (3) *Peas*, (4) *Beans*, (5) *Oats*, *Barley* referred to more particularly in March, *Vetches* and *Sainfoin*, also described next month, (6) *Parsnips*, and the planting of *Potatoes*, generally done rather later in the year. In addition to these, the management of the livestock, especially of breeding (7) *Cows*, (8) *Ewes*, and (9) *Swine*, occupies a great deal of the attention of the farmer this month. (10) *Fences* may be planted in February. *Irrigation*, and the manuring and other management of grass land will need attending to.

I.—THE RELATION OF LANDLORD AND TENANT.

Whatever it be, it ought to be defined in a written agreement between the two. The tenant would then know what to do; and any evils in the arrangement would tend to correct themselves. Take, for instance, the case of Mr. Wetherall, of Kirkbridge, tenant of his Grace the Duke of Northumberland. He was required, a few years ago, to bind himself to the performance of a number of stipulated acts of cultivation, under heavy penalties. There was nothing which the Duke of Northumberland did in requiring this agreement which it was not fully competent for his Grace to do. The articles on which he insisted as the only terms on which his land should be let were quite within his rights as owner; and Mr. Wetherall, his tenant, who gave up his farm rather than bind himself to their performance, had no legal grounds of complaint on account of the loss that he sustained. The policy of a relationship such as the owner then insisted on—such as the tenant then declined—is, nevertheless, a perfectly proper topic for public criticism. The impolicy of old-fashioned articles of agreement, handed down by copy after copy from models of a century ago, stands out boldly, and therefore usefully, when their proper fruit is borne. No tenant of intelligence and resolution and ability—if he be a free agent—will undertake the cultivation of land except on conditions which permit the exercise of that judgment by which he expects his capital to yield its annual return.

Any landowner may, of course, refuse to allow the growth of hemp, rape, turnip, or flax as seed crops. He may require a rent of 10*l.* for every acre above a certain quantity which shall be in potatoes in any one year—manured with at least twelve tons of manure to an acre. He may require 5*l.* an acre for every acre of arable land on which more than two crops of corn shall be taken to one of fallowing. He may insist that all the dung made each year shall each year be used and spread—that a certain length of fencing shall each year be cut and scoured—that the moles and rats be all destroyed—that twice in every year, at proper seasons, the rushes, thistles, weeds, be mown, and whins and brambles stubbed up, which

shall be found growing upon the pasture fields, sides of arable land, and in the lanes and hedges adjoining the premises. And in case the premises are not repaired, the moles destroyed, and the grass grounds scaled, the hedges and fences properly cut and scoured, and the rushes, thistles, and weeds twice mown, and the whins and brambles stubbed up within two months after notice by the landlord or his agent, he may employ proper persons to do the same, the expense whereof shall be paid by the tenant, to be recovered in the same way as arrears of rent.

It is perfectly competent for the owner of land to require and do all this, or even to descend to still greater detail, and enforce his own mode of cultivation with minuter particularity—connecting every departure from his rule with a severer penalty than any named in the particulars of agreement before us.

But such a system produces its natural fruit when the land as its consequence falls into the hands of an inferior order of men, as to intelligence, capability, and independence. Mr. William Wetherall, of Kirkbridge, pointed out to his landowner that some of the conditions to which he was thus required to bind himself were impossible of fulfilment—that others were unjust when taken in connexion with those on which he had entered to his land. It needed no one to point out that in his case no stringency was needed to ensure good culture—that had already been exhibited. His farm but lately had received—its tenant from its owner—the premium as the best cultivated in the district.

The dismissal of such men is the natural consequence of attempts to enforce the observance of conditions such as have been named; and it is an instance of self-inflicted injury on the landlord, when he insists on detailed and absurd stipulations as to cultivation in the case of land let on lease for a term of years.

Tenancy at Will.—Of the results of entire uncertainty of tenure, excepting only that security which custom and public opinion give, we have ample evidence in the condition of whole districts. Compare Norfolk, Lincolnshire, portions of the north of England, and great part of Scotland, on the one side, where leases, or their equivalent, have long been customary, with midland, southern, and western England, on the other, where leases are not customary. It is singular how, in a degree which cannot be altogether explained by differences in soil or climate, the first-named districts are almost entirely arable, while the last-named are pasture. There is a vast difference between these two conditions of land, the former yielding food and employment in abundance; the latter yielding both but scarcely. In the case of arable lands held on lease, there is an investment of capital in a manner in which it is not immediately convertible, and this is obviously the result of that confidence which is inspired by a hold in law upon the land. In the case of pasture

lands, which are rarely held on lease, the mode in which the tenant's capital is invested—in live stock, which may be driven to market to-morrow—equally exhibits that want of confidence on the part of the farmer, by which he is necessarily affected, under a system which renders him at any time liable to be the victim of a whim or an accident.

The Lease.—Whether, however, the land be arable or pasture, the grant of its use for a term of years is productive of the greatest benefit to all concerned. Look at the influence of such a deed upon the landowner. Will it not make him more careful in the selection of his tenant, than if he were able to get rid of him by a six months' notice? Caution of this kind would be beneficial to all classes—to tenants, landowner, and labourers—it would raise the standard of the first, secure the interests of the second, and, as good farming would be its consequence, it would insure employment for the third. Look at the influence of a lease for a sufficiently long term of years on the farmer—if he be a man of skill and sufficient capital, he will immediately avail himself of the security he enjoys, in order to invest his money in those improvements of the land which, though unquestionably the most profitable of any in the long run, are nevertheless somewhat dilatory in repayment. The security of the tenant may not *create* good farming—his energy and intelligence must have the credit of that—but the good farming will not exist without this security; and where tenants are possessed of the requisite energy and capital, leases should be granted to them. The whole subject is well illustrated by the following case:—

On the Beeston cattle estate (Cheshire), in the possession of the late Sir Thomas Mostyn, leases were granted for terms of twenty-one years. Only two individuals out of thirteen who received these leases made use of the security and advantages thus afforded them. As to eleven out of the thirteen, we are informed they and their land remained alike in *statu quo*. Some of those men had not the necessary means of effecting material improvements—some few were in better circumstances, and better results might have been expected. There were, however, two individuals who had the good sense to set to work at once to put their land into condition—Mr. Bird, of Beeston Hall, and Mr. Jones, of Park Gate. They drained extensively, and they manured with bones at an expense altogether of from 10*l.* to 12*l.* per acre. Such was the change produced by management on Mr. Bird's farm, that where his predecessor made about twenty-five or thirty cwt. of cheese per annum, he made upwards of four tons, and maintained besides as much stock in horses, and young cattle unproductive of milk, as had been before maintained. Mr. Jones adopted a course of treatment similar to that of Mr. Bird. It was known

to his neighbours, that before he drained and boned, he kept only twenty-three cows; his land afterwards maintained forty-six, and such of his lands as were in tillage before are in tillage still, and partake of the good management bestowed upon his grass lands.

This case proves how important, in a national as well as individual point of view, would be the effect of granting leases to well-selected tenants.* Unquestionably, as it has been well put by Mr. Hoskyns, of all the "good understandings" that can subsist between landlord and tenant, the best is that which is recorded in the signature to a well-drawn lease, not crammed with unnecessary or antiquated stipulations and provisions at variance with advanced science and improved practice, but simply defining the term, which should always be dependent upon the course of cultivation. Whatever number of these "courses" the lease may grant, it should expire at the expiration of the course. Should the four-course system be adopted, the term granted should be some multiple of four—eight, twelve, sixteen, or twenty years, according to the original state of the land, and the outlay of capital required and intended.

On the length of term—a point of great importance to both landlord and tenant—it is the experience of Mr. Grey, of Dilston, than whom we have no better authority on the relations between landlord and tenant, that where no unusual outlay is required for improving a farm, fifteen years is a sufficient length of term for an owner to relinquish the power over his property, and for a tenant to have a fair course of crops; and in holdings of small size, he says:—"I see no need to alter that opinion. But in offering two large farms to let last autumn, believing that tenants of large means are not willing to remove and establish themselves in concerns demanding great capital without the prospect of lengthened occupation, I offered them on leases of fifteen or twenty-one years, as parties might propose. The result was, that of ten proposals for one farm, which was eventually let at a rent of 2000*l.*—only three offered for both terms, and mark the difference of the offers. One for fifteen years was 1630*l.*, but for twenty-one years 1760*l.*, viz., 130*l.* more for the longer term, during the whole lease. Another for fifteen years was 1620*l.*, but for twenty-one years 1730*l.*, being a difference of 110*l.* per annum. Another for fifteen years was 1400*l.*, and for twenty-one years 1626*l.*, making the great difference of 226*l.* The other seven competitors offered only for a term of twenty-one years. Then, for another farm offered on the same conditions, and let for 1305*l.*, of six parties, not one proposed for the shorter term."

This shows plainly enough that all that tenants possessed of

* These instances were quoted some years ago, in a lecture on this subject by Mr. Maugham, of Dudley.

capital and intelligence require, is the use of the land for a long enough period of years to ensure the profitable employment of their capital. If to this there be added such an arrangement on leaving the farm as shall act as a premium on good cultivation till the very close of the term, then the relationship of landlord and tenant will be perfect.

Tenant Right.—But there are large districts in this country where no leases are prevalent—where the security of the tenant's residence on the estate (the permanency of his home) depends on the custom, and the character of the owner—and where the security of the tenant's capital is provided for by the observance of what are called "Tenant's rights." In Lincolnshire, where this system chiefly obtains, it has resulted in a high degree of fertility over the districts thus affected.

When the tenant leaves the farm, he is allowed a certain proportion of the sums spent by him in past years in various acts of cultivation or improvement, varying in amount according to the number of years which have elapsed since the expenditure. It is plain that when the proportion thus allowed is liberal, there is every encouragement to a tenant to proceed with liberal farming, whether he is under notice to quit the farm or not.

Mr. Williams, agent to the Earl of Yarborough, thus described the custom of tenant right prevalent in North Lincolnshire, in the *Journal of the Agricultural Society of England*:—

"The usual allowances in the north of Lincolnshire to outgoing tenants for unexhausted improvements are as follows:—

"Bone-dust.—This is considered to last for three years, and a tenant quitting in the spring of 1861 receives therefore two-thirds of the cost of what he put on in 1860 (one-third being supposed to be exhausted by his turnip crop), and one-third of what he put on in 1859, of which he has had the benefit of the other two-thirds in the crops of that year and of 1860.

"Precisely the same principle is adopted in the following improvements, the only difference being the number of years which each is assumed to last, and which are as follows:—

"Marl or chalk, seven years.

"Lime, five years.

"Clay, put on sandy land, four years, and on some estates seven years, which is probably a fairer allowance.

"Draining with tiles or stone, when the tenant pays the whole cost, seven years. This is, however, now a rare case, the usual practice being for the landlord to find the tiles. In this case the tenant has generally no allowance for putting them in if he has had a crop off the land, though he certainly ought to have a proportion of the cost, as it must often happen that the first crop will not pay

for the labour of draining. It would be probably right to put this on the same footing as bones.

“Draining with sods or thorns, four years. This allowance, I believe, is not always made. Indeed this mode of draining is now not much practised.

“The tenant is also paid the cost price of the seeds sown the spring previous to quitting, and for the labour of sowing, &c., provided they are not stocked after the 1st of November, and have not been unfairly stocked before.

“When seeds are ploughed up for wheat the autumn previous to quitting, he is allowed for herbage until the end of the term; but it is not usual to allow anything on ploughing up clover-stubble for wheat, that being considered the crop which ought to follow clover as a matter of course.

“For naked fallow, on strong land, he is allowed for ploughing and all the labour performed, but not for rent or taxes, unless he paid for them on entry. The cost of seed and labour on corn sown for the incoming tenant is of course always paid by the latter.”

“On some estates buildings are allowed for, like other improvements, on a term of twenty years.” “In addition to these allowances, a fresh one for oilcake given to stock has been established on Lord Yarborough’s estate. The allowance is based on the assumption that the manure is improved to the extent of one half the value of the oilcake consumed; but to get a fair average as to both quantity and price, it is made to extend over the last two years, and the allowance is two-sixths of the cake used in the last year, and one-sixth of that used in the previous one, making together half a year’s consumption.”

To this I add another table of allowances, adopted on some estates on the recommendation of Mr. Humberston, of Chester:—

DESCRIPTION OF IMPROVEMENT.	CONDITIONS ANNEXED.	RATE OF COMPENSATION TO BE ALLOWED ON QUITTING.
1. Fine ground bone and half-inch bones	On drained or naturally dry tillage land	Two-thirds of the cost of what has been used in the last year of tenancy, and one-third of that used in the year preceding.
2. Bone dust and half-inch bones	On dry or well-drained pasture or meadow land, the same not being afterwards mown	Seven-eighths of the cost of that used in the last year of tenancy, and diminishing one-eighth every previous year subsequent to the application.
3. Dissolved bones or guano	On dry or well-drained land.....	One-fourth of the cost of that used in the last year of tenancy for Turnips and Rape.
4. Lime.....	On dry or well drained land.....	Three-fourths of the cost of that used in the last year of tenancy, and one-fourth of that used in the preceding year.
5. Linseed-cake	Consumed on the farm	Three-fourths of the cost of that used in the last year of tenancy. The manure being carefully preserved in the foldyard.

DESCRIPTION OF IMPROVEMENT.	CONDITIONS ANNEXED.	RATE OF COMPENSATION TO BE ALLOWED ON QUITTING.
6. Draining — landlord finding tiles	Provided the drains are not less than three feet deep at regular distances, and cut under the superintendence of the landlord or his agents, and are in perfect order at the expiration of tenancy	Four-fifths of the expense of cutting, laying, and filling in the drains made during the last year of tenancy, and diminishing one-fifth for every crop grown on the land since it was drained.
7. Draining—tenant finding tiles	Same proviso as above	Six-sevenths of the cost of those made in the last year of the tenancy, and decreasing one-seventh for every crop grown since it was drained.
8. New buildings or walls — landlord finding materials	Provided the same are done under the direction and approved of by the landlord or his agent, according to plan and specification previously agreed upon	Nine-tenths of the cost of those erected in the last year of the tenancy, and decreasing one-tenth for each year's occupation after erection.
9. Ponds	Same proviso as above	Nine-tenths of the cost of those made or filled up in the last year of the tenancy, and decreasing one-tenth for each year's occupation after completion.
10. New walls or buildings — tenant finding all materials	Same proviso as above, tenant keeping and delivering up in good repair	Nineteen-twentieths of the cost of those made in the last year of tenancy, and decreasing one-twentieth for each year's occupation after erection.
11. New fences of hawthorn — landlord finding posts and rails	Provided they have been properly protected and cleaned	Nine-tenths of the cost of those made in the last year of tenancy, and decreasing one-tenth for each year's occupation after completion.
12. Clover and Grass seeds	Provided proper seeds have been sown in a husbandlike and proper manner, and have not been depastured or trod by stock	The invoice cost of seeds sown in the last year of tenancy.

It is plain that there is nothing in the two systems of lease and tenant right to make them antagonistic; they should be combined in order to the best result. The amount of rent offered for the use of land will depend upon the security, freedom, and advantages granted to the tenant. The best right which he can demand and secure for himself, when arranging the terms of his occupation, is that of peaceable possession of the land for a term of years. And, as regards the owner, obviously the best policy he can adopt is that which shall secure the permanence of the tenant-made fertility which he may then expect.

The advantages of the lease to the farmer appear self-evident. The certainty of a home which it confers upon him, and the certainty of all the investments he can make under it, are essential to the satisfactory prosecution of his business. He who, apart from the nature of the bargain, and merely on the ground of its permanence, should refuse a lease of the land he occupies, must surely either be without capital to invest, or without the spirit necessary to make it useful. The question lies between a twenty-one years' or a six months' notice to quit. A landowner may object to the former, but that a tenant aiming at the profitable employment of farm capital should prefer the latter, is beyond comprehension. And I believe that, properly arranged, the longer term is the better for both parties; that the more, within certain limits, that their respective positions

are assimilated, the more will self-interest lead each to act well for the other; that, in fact, the longer the interest of the tenant in the land, the more earnestly will he aim at that permanence of fertility which is for the benefit of the landlord as well.

There are, however, two aspects in which the lease may be considered relatively to tenancy at will; for the certainty of its termination is no less influential on the farmer than the certainty of its duration. The tenant, if it be not his interest to do otherwise, will certainly endeavour, as the known period of his lease approaches, to recover as much of his outlay as the short-sighted policy which alone it is then his interest to adopt enables. Restrictive clauses are powerless against the ingenuity of a wilful opponent:—self-interest and the sense of a just claim will hinder the expensive appliances by which the fertility must have hitherto been maintained, and which, though profitable in the case of a three or four years' occupation, will never be made by a tenant under short notice to quit. And the consequence is, that in many districts the productiveness of the land is intermittent: the cultivator enters upon it after it has been impoverished by his predecessor; the first five years thereafter are a period of outlay and gradual recovery; the next eight or nine years may be considered one of entire convalescence, during which the land is at its maximum fertility; while during the rest of the term it suffers a gradual and ultimately an entire relapse.

The only remedy for this state of things—that by which the owner of land may expect to maintain a tenant-made fertility throughout the lease—is the acknowledgment on his part of a liberal tenant right at the close of it. It must be made as much the farmer's interest to cultivate "highly" during the last as during any preceding year of his occupation. The lengthened tenancy will have insured to the owner of the land the advantages which drainage and other permanent improvements can confer, and the "tenant right" acknowledged at the close of it will hinder the diminution of the current fertility which, as it is the only obvious indication of the value of land, has the greatest influence on the rental offered for it. It is as much for the incoming tenant's interest to make the payment for this high current fertility of the land at once as it would be to spread it over half-a-dozen years—indeed, it is far more his interest to do this, for a longer period will remain during which he reaps the fruit of his outlay—and the rental therefore cannot suffer on this account. Let the tenant be able to say—"I hold land for a term of years on terms which render it my interest to cultivate it highly till the last. These terms are simply the acknowledgment of my right, when the lease terminates, to the full value of all the produce of that cultivation, and to so much also of its cost as shall then remain unexhausted on the land. And the guide to the valuation

is the document which specifies the similar valuation on behalf of my predecessor on the commencement of our tenancy. Leaving at Lady-day, I am thus insured the payment of 3s. 6d. per cubic yard for all made farm-yard manure—will not this induce abundant growth of straw in the previous year?—and there is no better test of fertility than the growth of bulky grain crops. I am also insured the expenses hitherto of the young wheat crop, my entry having been at spring time, and with this, half the cost of manure and cultivation spent on the preceding root crop is to be repaid me. I am to be paid the market value of all unused straw, without liberty to move it; and I have permission to consume my roots in the buildings up to a sufficiently late period of the year.” If there be any difference, the tenant, under such circumstances, has a greater inducement to cultivate well during the last than during any previous year of his lease. His successor will find his otherwise five-years’ outlay satisfactorily condensed into a single payment on entry, and the whole period of his lease will thus be one of uniformly profitable cultivation. His landlord will find that a high actual fertility is most influential on the offers of rent he receives. His labourers enjoy constant work till the close of his occupation. And the country, of course, benefits by the uniform productiveness of his land. I believe that the lease, as the encouragement of works for the permanent benefit to the land, with a “tenant right” at the close of it in reference to those acts of cultivation on which its current fertility depends, is the bond of relationship between landlord and tenant which the most effectually serves the interests of all parties.

The conditions of a lease form, of course, an altogether different subject of consideration: one to which your attention will be directed before Michaelmas, which is the commonest period of entry to arable land in this country.

Tenant-right Legislation.—So obvious are the advantages to all of any system which encourages the outlay of a tenant’s capital on the land, that attempts have been made to secure for him by law a right to his unexhausted improvements at the end of his tenancy; but the subject seems fitter for private agreement than for interference by legislation.

In order to define what is due to an outgoing tenant, it would be necessary, according to the report on this subject, in 1848, to the Law Amendment Society, to determine not only “(1) the annual value of the land at the commencement of the tenancy, which might, perhaps, be obtained by reference to the rent, and the poor-rate assessment; (2) not only the annual value of the land at the end of the tenancy, which would require a special valuation; (3) not only proof of the fact that the improvements were made; (4) but also proof of the extent to which the improvements alone, as distinguished from other co-operating circumstances, have affected the

value. Now, without taking into consideration the three former requisites, this last proof alone it would be almost impossible to give." Clearly the tenant has no right to the whole difference in the value of his farm at the commencement and close of his occupation. That may have arisen from the increase of population or of prices, from the improved condition of the people, from the neighbourhood of a lately constructed railroad, or from the settlement of a manufacture in its neighbourhood. From these causes in which the tenant has had no part, as well as from the fact that at such a date so much was spent in draining, liming, or manuring the land, has its increased value arisen; and who is to eliminate that portion of the result due to this, which is only one of its causes?

Indeed, a great *apparent* increase in the intrinsic value of an estate may often arise from a comparatively inexpensive act on the part of its cultivator. Draining, liming, or subsoiling, will sometimes increase the value of land far beyond the cost of the operation; but notwithstanding this, no claim can justly be made for *more* than this cost: its effect has been so great, not because it has added to the soil anything for which the tenant paid, but because it developed and brought into action that which though dormant there, had a pre-existence as the property of the landowner.

The most fertile soil, if blocked up with water, loses its fertility; the roots of plants growing on it will exhaust their respective localities of the food proper for them, and then linger and die; but break up this stagnation, allow the water to circulate, as by drainage you may, and every successive shower will prepare fresh food, and, as it passes these roots, furnish them with fresh supplies of nourishment—of nourishment, observe, not added by the tenant, but existing in the land before he came to it. The increased fertility cannot be claimed as the tenant's own—the warehouse was full of food before his occupancy—he was only at the expense of the key. Here, then, is a new difficulty. Who is to determine what portion of the increased value of the land is due to its cultivator as the addition of real material at his cost, and what portion of it is a mere alteration of character, due no doubt to him as the instrument, but which he could not have effected had not the very basis of that character already existed—the landlord's property—in the soil?

The case against tenant-right legislation then is simply this:—It is impossible. It is the voluntary establishment of tenant-right that must be urged. The only period at which it can be successfully enforced occurs in the case of every farmer just before he enters his farm. It is a subject proper for private agreement, not for public enactment. But what an absurdity it seems to be, speaking of enforcing this matter as *against* landlords, when of all the parties to the occupation of land, they would benefit the most

by an agreement which should leave it in an improved condition.

Who has any interest in a system which induces the investment of capital in cultivation, if the landlord has none? He of all should be the loudest in condemning unprotected tenancy at will—that miserable system on which large tracts in this country are still held—and to which, with its invariable attendants, ignorance and want of enterprise, we must attribute the bad farming which over such districts still prevails. Land is valuable just in the degree in which capital is invested in its cultivation. A mode of tenure which should induce a doubly high cultivation would double the value of an estate. Let any landlord select the best fields on each of his farms—those paying the highest rent. Are they those originally or *intrinsically* the most valuable—those which the geologist would point out as occupying the most favourable sites—those whose subsoils would indicate extraordinary fertility? No—whatever their subsoils may be, they are invariably the *home grounds*, where the *tenant*, whether he intended it or not, has been most actively at work; those nearest the dung-heap, and whose cultivation has been the most costly. Is it not, then, the interest of the owner that his tenant should be encouraged to farm liberally and with energy?

These general remarks on the relation of landlord and tenant are offered with propriety at a period of the year when many are looking out for farms. The details of a Lady-day and a Michaelmas entry will be given in March and September respectively.

II.—FARM BUILDINGS.

“On this subject,” says Lord Torrington,* “I cannot do better than point the reader’s attention to the buildings of the calculating manufacturer (be his occupation what it may). Observe the arrangement of his premises: mark how judiciously they are placed with a view to the economy of time and labour, aided by excellent machinery, so contrived and placed as to be easily accessible for all the purposes for which it may be required; and by this combination of power, producing his goods in a short period, and at the lowest possible cost; thus enabling him to sell at remunerating prices. Why, I ask, may not the same objects be kept in view in the erection and arrangements of farm buildings?”

This is the true point of view from which to regard this subject. Economy in the application of labour is one chief road to profitable farming. The manure made on a farm is the main stay of its fertility; let it be made and provided on such a spot as that the car-

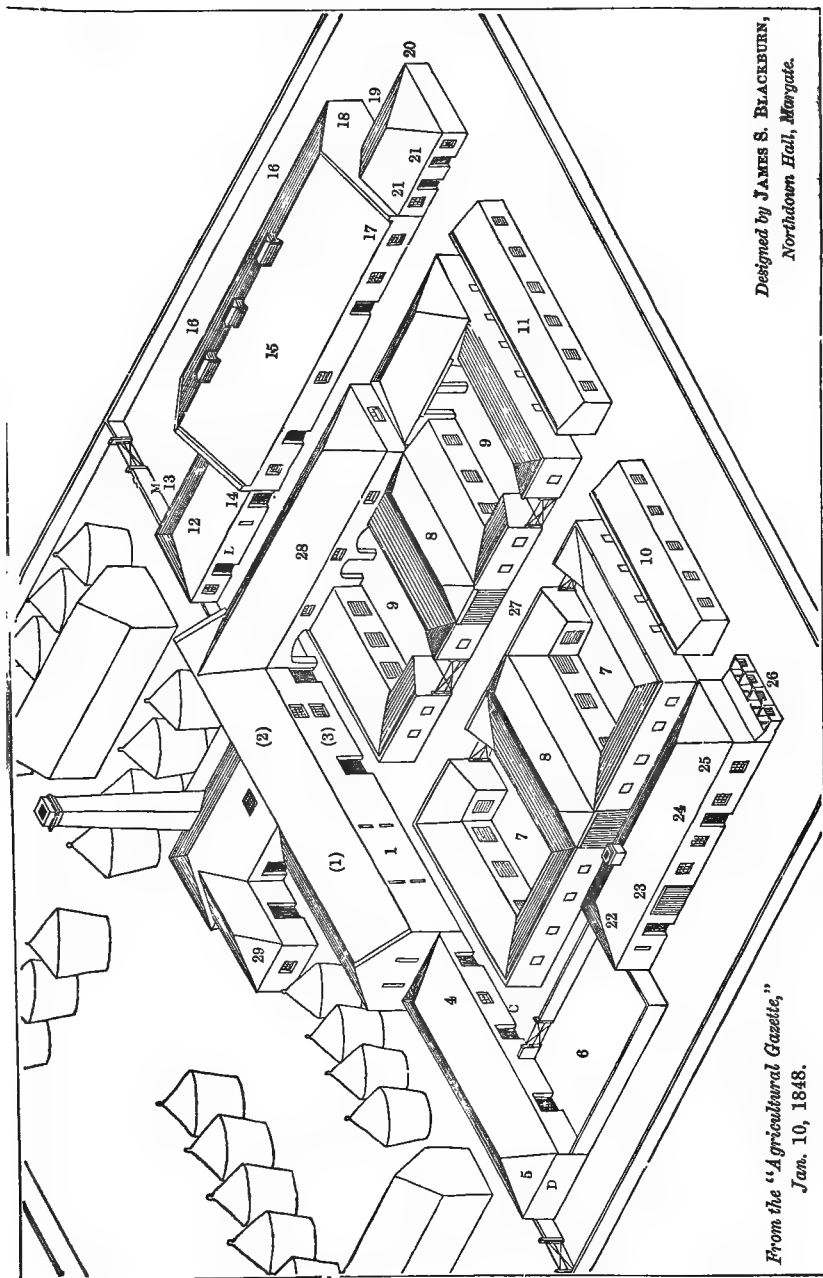
* On Farm Buildings. Ridgway, Piccadilly.

riage of it to the various parts of the farm may be effected at the least expense of labour—this will also be the spot on which the produce of the farm, whether it be grain, roots, or hay, may be concentrated with the least labour of carriage. On this spot, then, let the farm-buildings be erected; due regard being had to a suitable aspect, the means of drainage, and a supply of water; and let the various parts of the whole have such a relative position as may be compatible with the greatest economy of the labour carried on within them. Immediate connexion should be made between the stack-yard, barn, granaries, and straw-house; and both the last-named and the root-stores should be immediately in connexion with the feeding-stalls, the byres, stables, cattle and sheep-yards, and pigsties. The stables should be near the implement and cart or waggon-sheds, which should have a northern or eastern aspect, and over which, in order to diminish the labour of loading, it is well that the granaries be situated. Careful drainage of the stables, byres, feeding-stalls, and yards, is an essential feature in any good system of farm-buildings—the liquid manure, if not absorbed by litter, being hoarded in tanks by the stance for the manure, so that the latter may be easily soaked with the water before being removed. Let these general features of the plan be scrupulously attended to and developed on as small a space of ground as may be compatible with easy and roomy arrangement of parts—let the accommodation afforded by the several parts be duly in accordance with the wants and capabilities of the farm—let the fitting-up of the several parts be according to the best methods, due regard being had, among other things, to perfect ventilation, and the result will doubtless be a great annual saving in the farm expenses, and a considerable addition to the farm receipts.

On a farm of 400 acres, adopting the plans and estimates of Mr. Cook, of Holton Hall, Suffolk, where an excellent farmery was lately erected, these items amount to at least 100*l.* a year, which is 5*l.* per cent. on 2000*l.*, quite enough to cover the cost of buildings for such a farm, and enough therefore to justify the outlay.

The essential parts of a farmery are, (1) stabling for the farm horses; (2) threshing barns and granary for the storage of grain; (3) shelter for live stock. Besides these there are in all complete buildings, straw barn, house for preparation of food, and cart and implement sheds. It is on the third of the above departments of a farmery that its character will depend. Cattle are kept in yards covered or open, in stalls or in boxes. In all cases the stabling and threshing barns and granaries are somewhat alike, but the provision of accommodation for the cattle and feeding stock very materially varies. I propose to give three or four plans and drawings illustrative of as many different farmeries, and point out the merits of each.

1. The following (Fig. 8) represents a set of buildings designed



Designed by JAMES S. BLACKBURN,
Northdown Hall, Margate.

From the "Agricultural Gazette,"
Jan. 10, 1848.

by Mr. Blackburn, of Northdown Hall, Margate, in which accommodation for barn-fed cattle is well but expensively provided. The references to the index figures are as follows :—

- | | | |
|---|---|---|
| 1. Straw barn. | 10. Five loose boxes for cattle. Boxes 10 feet by 9 feet. | 25. Loose box. |
| 2. Threshing barn on the upper floor. | 11. Six loose boxes for cattle. Do. do. | 26. Piggeries. |
| 3. Corn barn on the lower floor. | 12. Loose box. | 27. Covered liquid manure tank, holding 11,000 gallons. |
| 4. Cow byre. | 13. Hen-house. | 28. Granary which extends to the south wall of 8. |
| 5. Calves' hammels, or for young horses, &c. | 14. Hay-house. | 29. Carpenter's and blacksmith's shed. |
| 6. Yard for ditto. | 15. Work-horse stable. | |
| 7,7. Quadrangles, containing loose boxes for 13 beasts, with manure-pit in the centre. Boxes, 10 feet by 12 feet. | 16,16. Cart-shed. | |
| 8,8. Stores for turnips or other roots. | 17. Loose box. | |
| 9,9. Cattle boxes for 15 beasts, as in 7,7. | 18. Manure store. | |
| | 19. Herd's store. | |
| | 20. Slaughter-house. | |
| | 21,21. Loose boxes. | |
| | 22. Hay-house. | |
| | 23. Gig and harness house. | |
| | 24. Riding-horse stable. | |

In addition to the above, the position of the steam-engine and boiler-house is sufficiently indicated by the chimney, and under that roof the steaming apparatus for preparing cattle food is also placed.

This plan possesses many obvious merits. Thus the reader (who looks at it from the south-west) will see that the whole is sheltered by high buildings on the north and east: the cart and implement sheds have a dry and cool eastern exposure: the feeding-boxes are for the most part together: straw and roots are easily accessible from them: the cow-byre and calves' house, connected together, are also both of them near food and litter: the stable, detached from the rest of the buildings, is not at an inconvenient distance from the straw-house, and it is close both to hay and to the granary where the horse-corn is kept; and if a communication be opened through the central wall of that building, it is in immediate communication with the implement-shed. All the private accommodation—gig-house, riding-horse stable, &c., for the farmer's use as distinguished from that of the farm—is separate from the rest of the buildings. On the other hand, some faults are observable. One of them, is the distance of the steaming-house, where the cattle food is prepared; this is placed near the steam-engine, no doubt to have the use of the engine-boiler; but it would certainly be better more in the neighbourhood of the cattle-boxes and piggeries, even though a separate boiler and furnace should have to be erected for it. Another fault appears in the number of detached loose boxes scattered about at 12, 17, 21, and 25, which answer the purpose of filling the odd corners that would otherwise have made the place appear incomplete, but which will certainly require considerably more labour of attendance than if they had been along with the others in one complete stack.

There are many farmeries, some of which are represented in other pages, in which the cattle-boxes are collected together under one roof, and they have perfectly answered their purpose. The above plan, in which one side of every box is exposed to the sun and air, is expensive of room and of building also, though probably healthier

than where a very large number of cattle are congregated under one roof, and suffer from difficulties of ventilation.

2. In the next plan (Fig. 9) represented also in perspective in

Fig. 9.—*Plan of Coleshill Farmery.*

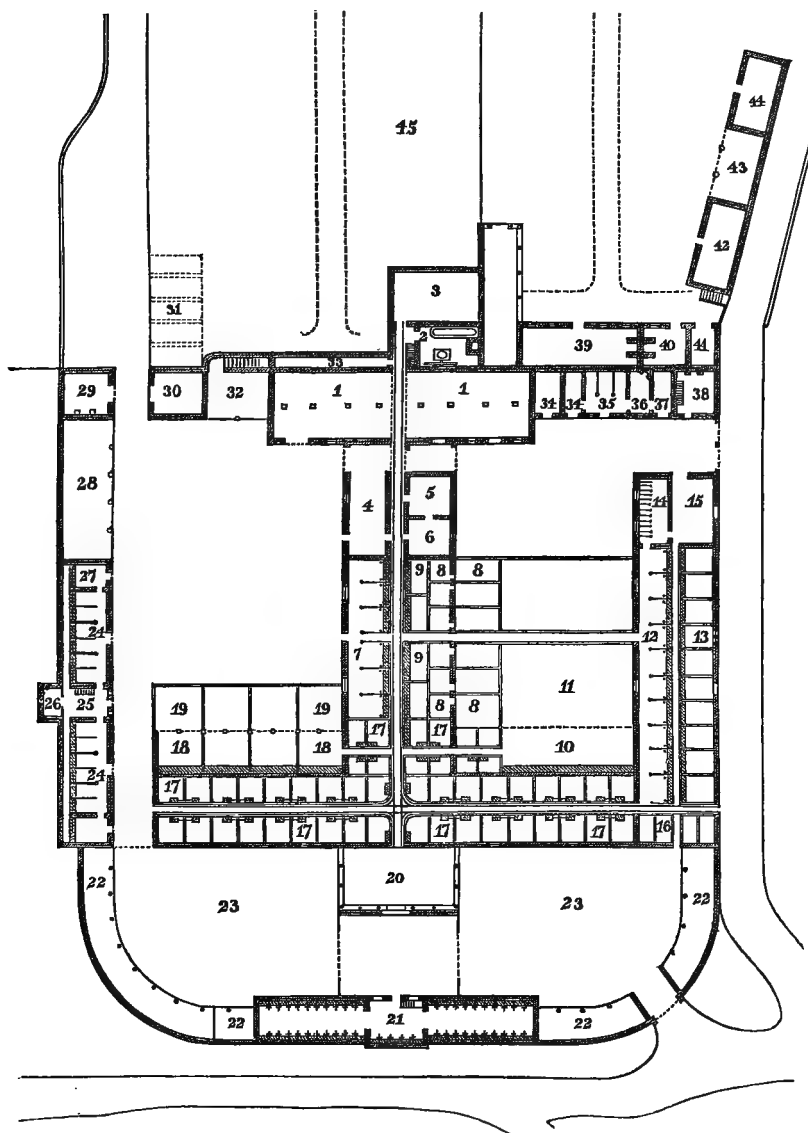
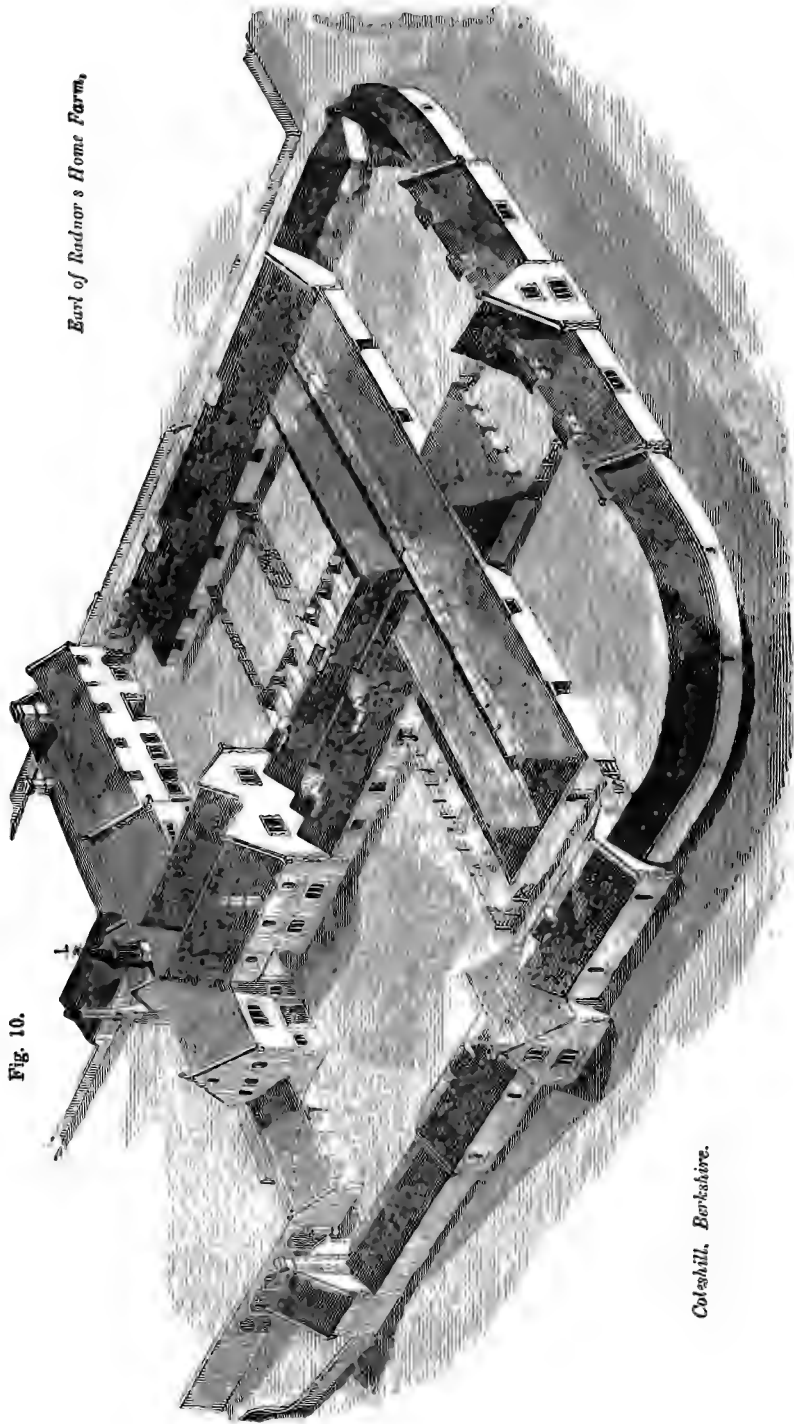


Fig. 10.

East of Radnor's Home Farm,



Coteshill, Berkshire.

Fig. 10, we have provision made for all the various methods of housing cattle. The buildings at Coleshill, Berkshire, the seat of the Earl of Radnor, are on the largest scale of farmeries, and confessedly in the style fitted for a nobleman's home farm. The execution, space, style and quality of work, and, therefore, the expense, are probably higher than the mere economy of the farm would justify. But for the principles of its arrangement, the skilful connexion of the different parts, the clever adaptation of the circumstances of the site, and the perfect adaptation of each part to its purpose, we know of few to equal it. Among its obvious merits are the admirable arrangement of threshing, grinding, and cutting machinery; the accessibility and roominess of the granaries, and their connexion with a cartway beneath; the relation of steaming-house and food stores generally with cattle boxes and stalls; the proper mixture of boxes, stalls, and yards—the first for fattening cattle, the second especially for stables (box feeding answering only in the case of animals continually standing on the litter), and the third for younger stock; lastly, the sheep-yards and the sheep feeding house over a sparred and open floor, which seems specially adapted, and we might say *only* adapted to the case of sheep, which carry their bed-clothes continually about them, and do not suffer from so hard a mattress.

The following references to the index figures on the plan will, with the assistance of the perspective drawing (Fig. 10), enable the reader fully to understand these buildings:—The barn is shown at 1, 1. 2 and 3 are the engine-house and coal-house—the power is communicated to shafting on the second-floor of the barn, from which threshing machinery and machines for winnowing, grinding, bruising, and cake-crushing are driven. From this shafting, too, turnip cutters on the lower floor of the barn are driven; they are supplied with roots from the stores in 33, close by, which are filled from the rick-yard, which is on a higher level; and from which therefore the grain to be threshed is also easily delivered on to the second floor of the barn. 4 is the chaff-house, and 5, 6, a steaming house. Over these, and connected with the threshing floor of the barn is the granary. There is a roofed gangway between the barn and the chaff-house, in which carts may be loaded from the granary: and it should be here mentioned that the second floor over 34, 35, &c., on one side of the barn, is also available as storage for grain. It is plain that hitherto the arrangements are exceedingly convenient. The corn is brought to the machine, its straw, cut into chaff, is stored away close by; its grain, winnowed clean, is also stored away close by, and is easily deliverable into carts. The roots are brought easily to the cutters, close by the power which drives them, and near to the chaff and other food with which they are to be mixed. Cake and corn crushers, close to the power which drives them, and to the store of food which they have

to prepare, deliver this prepared food at the very door of the food-house and the steaming house, whence, finally, food and litter are both sent out to the yards, byres, and stalls. These, accordingly, are arranged conveniently around this centre of distribution. A railway takes them down the central building, and, at its end, on either side, to boxes, stalls, and piggeries—7 being fattening stalls; 8, 8, pigsties opening into yards; 9, 9, fattening pigsties or boxes; 10 and 11, a shed and yard for young cattle; 12 and 13, stalls and boxes for cows; 14, a calves' house, and 15, hay-house; 16 are boxes for calves; 17, 17, fattening boxes for cattle; 18 and 19, yards and sheds for young cattle. At 20 there is a covered dung-pit, with tank underneath, where the soiled litter of all the cattle stalls may be easily concentrated; 21, still easily supplied from the food-house by the central gangway, is a house for fattening and other sheep on sparred flooring; 22 and 23 are sheds and yards available for sheep at the lambing season, or for young stock at any season; 24, 24, is the stable; 25 for corn, chaff, and hay-store; 26 for harness; 25 and 26 have bed-rooms over them; 27 is a loose box; 28, a cart shed, and for implements; 29, kitchen for boys and bed-room over; 30, a house for implements; 31, excavated archways for waggons; 32, also for waggons and carts, which may here be loaded from the granaries above; 33 is a root-store, already referred to; 34, 35, 36, 37, are provisions for riding horses, harness, and carriage house; 38, shepherd's house and bed-room over; 39, carpenters' shops; 40, office; 41, warehouse; 42, wheelwright's shop; 43, open shed; 44, warehouse. The yard partly enclosed by these last numbers, and by an open shed facing them, is a timber yard and sawyer's shed for the purposes of the estate; 45 is the rick-yard. An examination of the perspective drawing will show how the buildings lie on the successive steps of a sloping ground; the grain being built on the higher ground, level almost with the upper floor of the barns, and the general fall of the land being made available both for drainage and for the easy delivery of the food and discharge of the manure.

A careful examination of the whole will discover the fitness of those different parts to each other which are placed near to one another on the plan, as well as the adaptation of the whole to the circumstances of the farm, which is of 800 acres—500 acres grass, and 300 acres arable. These buildings were designed and erected by E. Moore, Esq., agent to the Earl of Radnor.

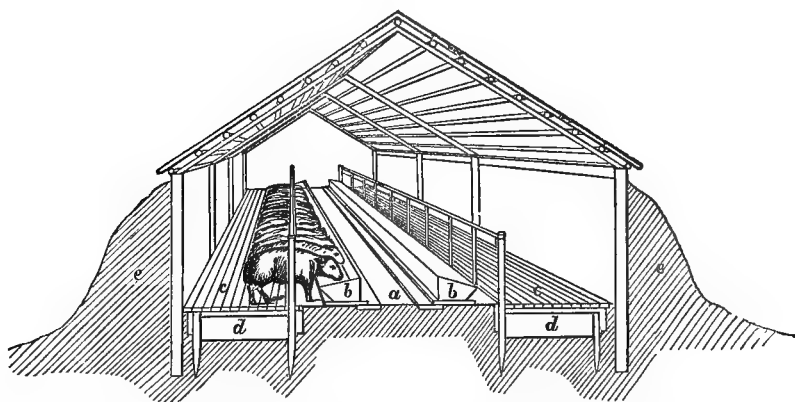
Two of the methods of feeding indicated in these buildings—viz., box-feeding for cattle, which is now everywhere adopted, and feeding on sparred floors for sheep, less commonly met with, deserve a further notice. The practice will be described in another month, but it may be added here that the accommodation for it may be much more cheaply provided than is the case in the buildings here illustrated.

The following, for instance, describes a cheap and yet efficient set of cattle-boxes which I used for many years on Whitfield Farm, Gloucestershire :—It was very cheaply erected against an east and west wall about six feet high, which had foundations about two feet deep. The ground was excavated eighteen inches. The sub-soil is a stiff clay. About ten feet out from the wall, posts were planted eight feet apart, the top of each being on a level with the top of the wall. These were connected with a set of strong poles from top to top, squared at the ends so as to rest on the uprights : and from the top of each there was also a strong pole reaching across to the wall and acting as a beam for the roofing. These beams supported a number of smaller larch poles parallel to the wall, about one foot apart, and on these was piled ridgewise a lot of faggots, which were thatched over. This was the shed. It was divided into boxes (one in each of the intervals between the poles) thus : From each beam there descended two uprights to the ground, in which they were sunk to a depth of eighteen inches. One of these uprights was three feet from the wall and the other three feet from the main posts, and there was also an upright about three feet from each post, descending from the front beam to the ground. These uprights and posts formed the framework, against which three or four horizontal strips were nailed, dividing the sheds into separate boxes, ten feet by eight. In one of the front corners, that in which was the post with the two uprights three feet on either side of it, stood the feeding trough, made by nailing from post to upright, and from upright to upright, a set of strips enclosing a triangular space, which was filled to a height of about three feet with coal ashes and then boarded over. This completed the business. The cattle were turned in upon the litter, and in three or four months, if put in fresh, were taken out fat, after having filled the eighteen-inch pit and risen about eighteen inches above the level of the ground. The whole labour here did not exceed 10s. a box. The boxes were open to the south, and furnished a dry lair and good shelter to the cattle, which improved rapidly in condition so housed.

For stall feeding or shed feeding of sheep, again, on a sparred flooring covering a tank for their manure, the outlay need not be excessively great. The following is the plan adopted in a case described in the *Agricultural Gazette* of 1848. Figure 11 represents a section and interior of the arrangement where stall feeding is adopted, each sheep being tied by the neck to its share of the common trough (*b*), which is supplied from a waggon traversing the central railroad (*a*). They stand on an open flooring (*c*), and their dung and urine pass into the tank below. The width of the shed may be from twelve to fourteen feet : each animal will need from eighteen to twenty-four inches in width : the

rail above the trough should just touch their shoulders when they stand under it to feed. The roof is of fir poles, the principals

Fig. 11.



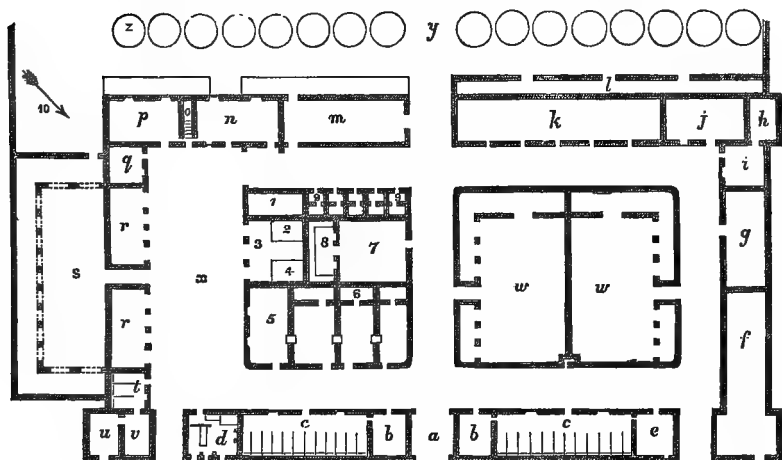
being connected by rods of ash, fir, or any other light wood. The uprights are oak posts, refuse of coppice thinnings; the stall rails are hurdle stakes. The tanks are sided with outside slabs, refuse of sawpit; the bottom is the natural bed of earth beaten hard, and half filled with sawdust or burnt earth. The whole of the above is to be found on most farms for the trouble of cutting down. The labour of the sawing of the slabs is hardly to be charged, as it belongs more properly to the planking cut from between the slabs. These materials, if already in existence on an estate, would probably be supplied gratis by the landlord; and for the thatch, heather or straw. The troughs may be of refuse fir slabs, the heavier the better, as the iron staples of the sheeps' collars and chains are driven into them, and clenched inside, and their own weight keeps them steady. The ends of the houses are wattled and thatched, the sides banked up with earth (*e*) taken from the tank, and raised to within six inches of the eaves; the outside slopes should be turfed or seeded.

In cold weather, if additional warmth is desirable, the aperture under the eaves may be closed by long bundles of straw laid lengthwise; and the central opening should also be closed at night by a wattled hurdle. The length of the sheep's chain is from seven to nine inches, long enough to allow the animal to lie down with its head clear of the trough, and not so long as to allow of its putting its fore-feet into it. Lastly, for each sparred floor, ten battens of two and three-quarter inches, three-quarter inch apart, cover two feet eleven inches, which area is quite sufficient for any sheep. These battens should be of inch larch, with bearings at

every three feet, and length to suit the openings of the side up-rights.

3. I now give the plan of a set of buildings (Fig. 12), erected at

Fig. 12.—Swanstone Buildings, near Edinburgh.



Swanstone, near Edinburgh, from the plans of J. Newlands, Esq., C.E., now Borough Engineer of Liverpool, because it well illustrates two of the cardinal rules of such architecture—viz., that all parts of like uses be classed and placed together, and all parts whose uses hinge on one another be close to one another. The following is the index to its several parts:—

a, Main entrance. *b*, Hay-house. *c*, Stables. *d*, Servants' house. *e*, Infirmary. *f*, Potato-house. *g*, Turnip-house. *h*, Bull-house. *i*, Bull-yard. *j*, Cow-byre. *k*, House for feeding cattle. *l*, Turnip bays. *m*, Straw-barn. *n*, Dressing-barn. *o*, Stairs. *p*, Store for rape cake. *q*, Tool-house. *r*, Cart shed. *s*, Implement yard and shed. *t*, Saddle-horse stall. *u*, Carriage-house. *v*, Harness-house. *w*, Shelter sheds and yards. *x*, Working-court. *y*, Stack-yard. *z*, Stacks placed on frames, numbered. (1) Steam-engine. (2) Engine-boiler. (3) Boiler-shed. (4) Boiler for steaming food. (5) House for steaming food. (6) H. mmels and yards. (7) Yard for poultry. (8) Poultry-house. (9) Figureries. (10) Course of prevailing winds. The granaries connected with the dressing-barn *n*, extend in an upper floor over *p*, *q*, *r*, *s*.

The arrow represents the course of prevailing winds. The first point deserving attention is the existence of a two-storied building extending from *r* to *m*; thus acting as a shelter to the whole: and it will also be seen that the cart and implement sheds are open to leeward.

It may next be noticed that all the parts of like use are together; thus, *h*, *i*, *j*, *k*, *w*, and (6), the bull-house, cow-byres, feeding-house, cattle-sheds, and hemmels (small yards) for fattening cattle are together; *c*, *c*, *u*, *v*, the stables, are arranged in one line; *q*, *r*, *r*, and *s*, the tool, implement, and cart-sheds, are connected; *m*, *n*, the

threshing and straw barns, and the granaries over *o, p, q, r*, are one building.

It will also be observed that the economy of labour has been attended to; buildings dependent upon one another in *use* are connected in *position*. Thus *b, b*, the hay-house, *d*, the servants' house, and *e*, the infirmary, are close by *c, c*, and *t, u, v*, the stables; *g* and *l*, the turnip-houses, and *m*, the straw-barn, are close by *j, k, w*, the houses for cattle; the granary is right over the cart-shed; the steam-houses are close by the piggeries, the poultry-house, and the stables; the horses have not far to go to the implements; the stack yard is close to the threshing barn.

But I may point out some further particulars by which the suitability of these buildings to the farm on which they are erected will be made to appear.

The farm is one of 600 acres of arable land, and 600 acres of hill pasture. It consists generally of what is considered good turnip soil, and is managed on a five-years' course of cropping; $\frac{2}{3}$ being in pasture, one and two years old in equal proportion, and no hay being made for sale; $\frac{1}{3}$ in green crop (potatoes thirty, and turnips ninety acres); $\frac{1}{3}$ in oats; and $\frac{1}{3}$ in wheat and barley, sown with grass-seeds; the former after potatoes, the latter after turnips. The turnips are consumed on the ground with sheep, excepting so much as is required for thirty cattle and twenty horses; four of the latter being young stock rearing for agricultural purposes.

From the care and attention that have been paid on this farm to the purity of the seed sown, a regular demand exists for spring corn, and a granary of great extent is thus a matter of importance, in which the farmer is enabled to store grain during the winter months, threshing it in order to use or sell the straw as occasion requires. A large storage for potatoes is also needed.

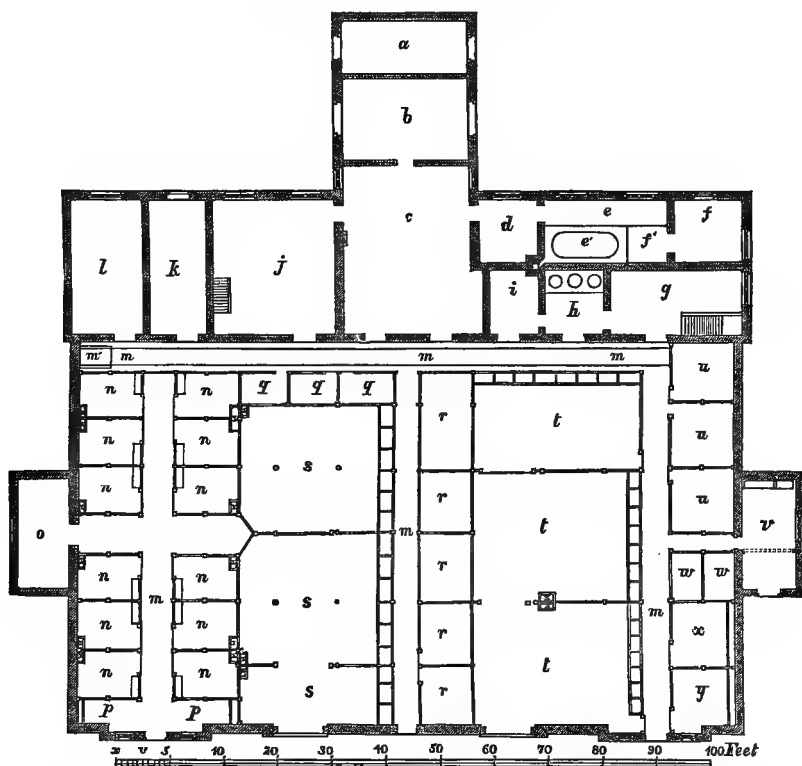
The circumstances thus recorded in which the farm is placed, taken in connexion with the leading principles common to all such erections which have guided the architect, will be found to afford a satisfactory explanation and justification of the arrangement of parts and development of each in the subjoined plan.

In this set of buildings the cattle are fed in small open yards or hemmels. Latterly, however, as already referred to at page 35, the practice of feeding cattle in covered yards has become prevalent; and it is justified by the more rapid fattening of the cattle, and by the better quality of the manure thus made. I propose, therefore, to give drawings of farmeries where this system is adopted.

4. At the Home Farm, Haines Hill (Figs. 13, 14, 15), Berkshire, on the estate of J. C. Garth, Esq., capital buildings have been erected on this principle by Messrs. Beadel, of Gresham-street, E. C., and their leading feature—extensive yards under lofty roofing—is more or less carried out at all the other homesteads which those gentle-

men have erected on the estate. The main block of buildings occupies a ground plan of about 140 feet by 100. There is a lofty range on the long side, which runs north and south, and from the

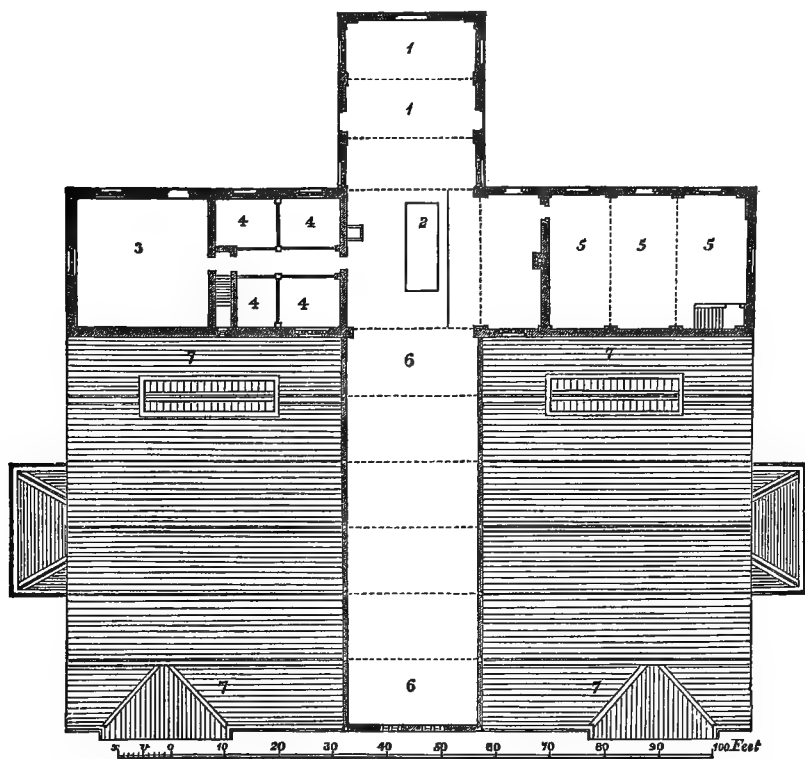
Fig. 13.—*Haines Hill : Ground Plan.*



middle of this projects a shorter piece of the same height towards the east; while the main block is an extension for about 100 feet westwards of the same roof of its full length, generally, however, of a somewhat lower elevation. The lofty range includes in its centre a very complete threshing machinery, worked by a steam-engine of eight-horse power—all erected by Messrs. Ransome, of Ipswich. On the one side of this centre-piece lie the granaries above and cattle-food stores with chaff-house below; and on the other side lies hay and chaffing apparatus above and roots below. The hay is put in from the cart or waggon outside, on the level of the upper floor; the roots are thrown in from the ground floor below. The corn to be threshed is thrown in on the upper floor at the end of the arm

of the buildings which projects eastward; the ground floor of that piece being occupied by carpenters' shops. The corn fed into the machine on the upper floor passes downwards, the chaff is blown out

Fig. 14.—*Haines Hill : Upper Floor.*

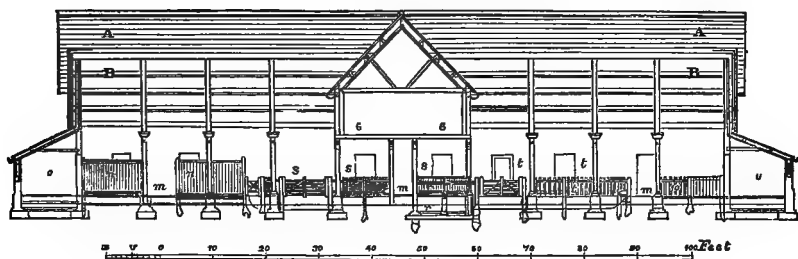


below; the straw re-appears, being lifted by the clever elevating shaker employed by Messrs. Ransome in their fixed barn machinery; and the corn being winnowed on its descent is brought upwards in elevators and passed through another winnower before it reaches the separators, from which it is delivered in sacks on the granary level. These are at once wheeled off to the stores, while the straw is carried away and stored on a floor on the same level, which extends under the higher part of the roof right over the covered yard below, from which it is thrown down for the supply of the yards.

From this floor you look down upon the yard below, and you see that the space is divided by three parallel gangways, extending westward from the north and south line of stores of chaff and roots, parallel with the sides of the yard. The two side gangways are about

four or five yards from the side walls, the middle gangway extends down the centre of the intervening space. As you walk down one of these side gangways, you have on either hand the boxes in which

Fig. 15.



the farm horses are kept solitarily, most complete in all their equipment, with manger, water-trough, &c., only boarded up so high as to make it a case of complete solitary confinement except in so far as each has a look-out on the gangway. As you walk down the other side gangway you have on one hand first boxes for cows, then little yards for sows with litters. On the other hand you have three yards each for six or eight cattle; either dairy stock, fattening beasts, or young and growing heifers and steers. The central gangway under the straw floor from which you see all this, has upon one side a long range of sparred flooring divided into yards for ten or a dozen sheep each, and containing about sixty Hampshire Down tegs, which, when I saw them, were evidently in thriving condition. On the other side, and between you and the horse-boxes lie another series of yards for fattening cattle. Over the sparred flooring on which the sheep are fed, gypsum is occasionally spread, and the whole is brushed over every now and then; but the sheep keep in capital condition; and when a lot have been brought in lame from the pastures they have soon recovered themselves on the sparred flooring. The yards are sheltered on the north and east by the highest portion of the erection, and being also walled up on the sides to the roof, they are left for the most part open on the western side. The ridge lines of the roof are glass, and there is ample window room for light, so that light and ventilation are provided along with perfect shelter.

Apart from this main block of buildings lies the manager's house, and outhouses, including dairy, slaughter-house, poultry-house, &c.

Figs. 13 (ground plan), 14 (plan of second floor), and 15 (cross section, from *o* to *v* on the ground plan), are sufficiently explanatory of this very efficient set of Messrs. Beadel's farm buildings. They cost, as a general rule, from 10*l.* to 14*l.* per square of 100 feet (10 feet square), varying according to the proportion of loftier building

erected and the preliminary difficulties of the ground. We add here the following references to the index letters:—

Fig. 13. *Ground Plan of Buildings at Haines Hill.*—*a*, Carpenter's shop. *b*, Sawing-room. *c*, Threshing and dressing room. *d*, Engine-room. *e*, Boiler-house. *f*, Boiler. *g*, Coal-house. *h*, Ash-pit. *i*, Meal-house. *j*, Cooking-room. *k*, Chaff-house. *l*, Mill-room. *m*, Root-house. *n*, Mixed food for horses. *o*, *n*, Gangways. *p*, *n*, Loose boxes for horses. *q*, Harness-room. *r*, Bailiff's horse. *s*, *q*, Calves' pens. *t*, *r*, Sheep boxes, with sparred floors. *u*, *s*, Cow-yards. *v*, *t*, Bullock-yards. *w*, *u*, Pig-sties. *x*, Bull-house. *y*, *w*, Breeding-sows. *z*, Horse-box. *aa*, Infirmary.

Fig. 14. *Plan of Second Floor of Buildings at Haines Hill.*—1, 1, Sheaf-lofts, fed from the waggon outside. 2, Threshing-machine. 3, Granary. 4, 4, Corn-bins. 5, 5, Store-loft. 6, 6, Straw-floor, extending over yard. 7, 7, Roof of yard.

Fig. 15. *Section across Yard of Buildings at Haines Hill.*—*A*, *A*, Roof of granary and barn. *B*, *B*, Roof of yard. 6, 6, Floor of straw-gallery (see 6, 6, Fig. 14). *m*, Gangways. *n*, Horse-boxes. *o*, Harness-room. *p*, Sheep-pen, with tank beneath. *s*, *s*, Cow-yards. *t*, *t*, Bullock-yards. *v*, Bull-house. *w*, Breeding sows.

In the same county are many other admirable sets of buildings, to which reference may shortly be made. Indeed, Berkshire, which includes the Royal farms near Windsor, Coleshill farmery, that at Haines Hill, and one now to be named at Englefield, near Reading, furnishes as good illustrations of farm architecture as are anywhere to be met with.

5. At Englefield, near Reading, the home farm of R. Benyon, Esq., M.P., the system of box-feeding is more systematically carried out than on any of the other farms yet named.

The buildings consist first of a block, some 50 feet by 100 feet, covered in by a double span roof, under which are forty-two boxes—six single rows of seven each—the rows being separated alternately by narrow gangways (three in number) for feeding, and by wider gangways (two) for carts entering to remove the dung. Each box has a manger for roots and hay, and a trough for water. They are separated by rough paling, and the cattle are hindered from dirtying their troughs by a loose pole which they have to lift before they can get at their manger. These boxes are cleaned out twice during the winter, and about three times in the year, being empty during summer and autumn. The price paid to the men engaged in filling the carts is 1s. the box, or 1d. per piled cartload. The boxes are three feet six inches deep.

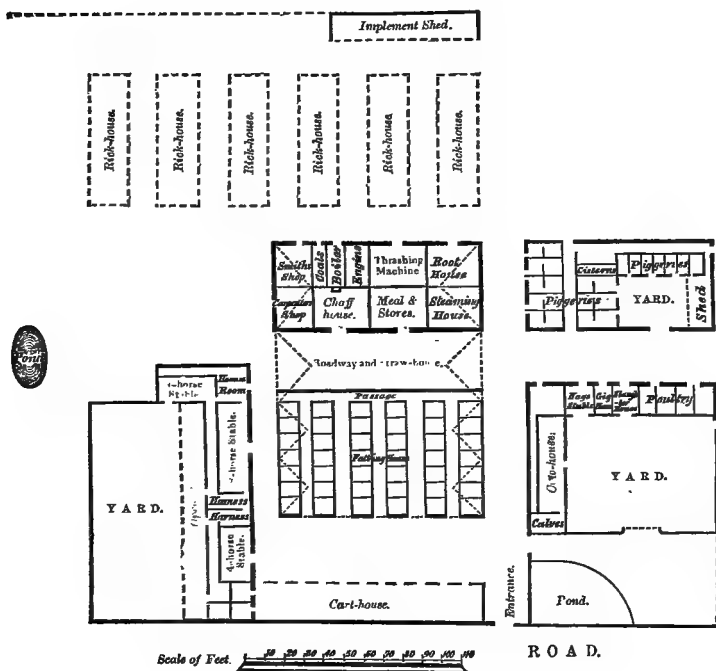
Another block of buildings of the same length includes threshing machines, granary, root-house, chaff-house, steam-house, and steam power (a fixed ten-horse engine, consuming eight cwt. a day of coals, and worked generally three days in the week). Between the two, the space is roofed over and occupied as a straw-house. The steam power is conveyed by strap to a longitudinal shaft upstairs, from which straps on pulleys carry it to threshing-machine, turnip-cutter, two pairs of mill-stones, two chaff-cutters, cake-crusher, and corn-bruiser.

The steam power is used to cut the roots for two days' supply by means of Samuelson's largest Banbury cutter; and to cut hay chaff at the rate of five tons in a day, two men feeding the chaff-cutter; also to crush oats and crack beans by Turner's capital machine for the purpose—all at one and the same time.

On the south side of this block of cattle-boxes is a shed for implements. On the west side is a range of stables, lofty and airy, with no particular nicety, but great convenience of internal arrangement, and on the other side, as a lean-to, are shedding and yards for the calves, of which fifty or sixty are kept in three divisions, provided with racks for straw and mangers for the roots, and chaff, and cake. North of the threshing machinery and barns are six long rows of open roofing for storing away the corn. The implement shed, barns, straw-house, granaries, and corn-sheds thus succeed one another as you go northwards. East of this range is a cow-byre, nag-stalls, slaughter-houses, poultry-house, &c., on two sides of a square, thus sheltering a yard for cows and calves from the north and east, and lying alongside of the cattle-boxes, and another square of pigsties and yards lying alongside of the granaries and threshing machinery. The corresponding space eastward of the rows of corn-sheds remains to be occupied by sheds and yards for cows, if it should be resolved to establish a herd of short-horns. The buildings were planned by Mr. Benyon and his steward, and erected by the workmen of the estate at a cost of about 3000*l*.

The following plan (Fig. 16) of these buildings is taken, by per-

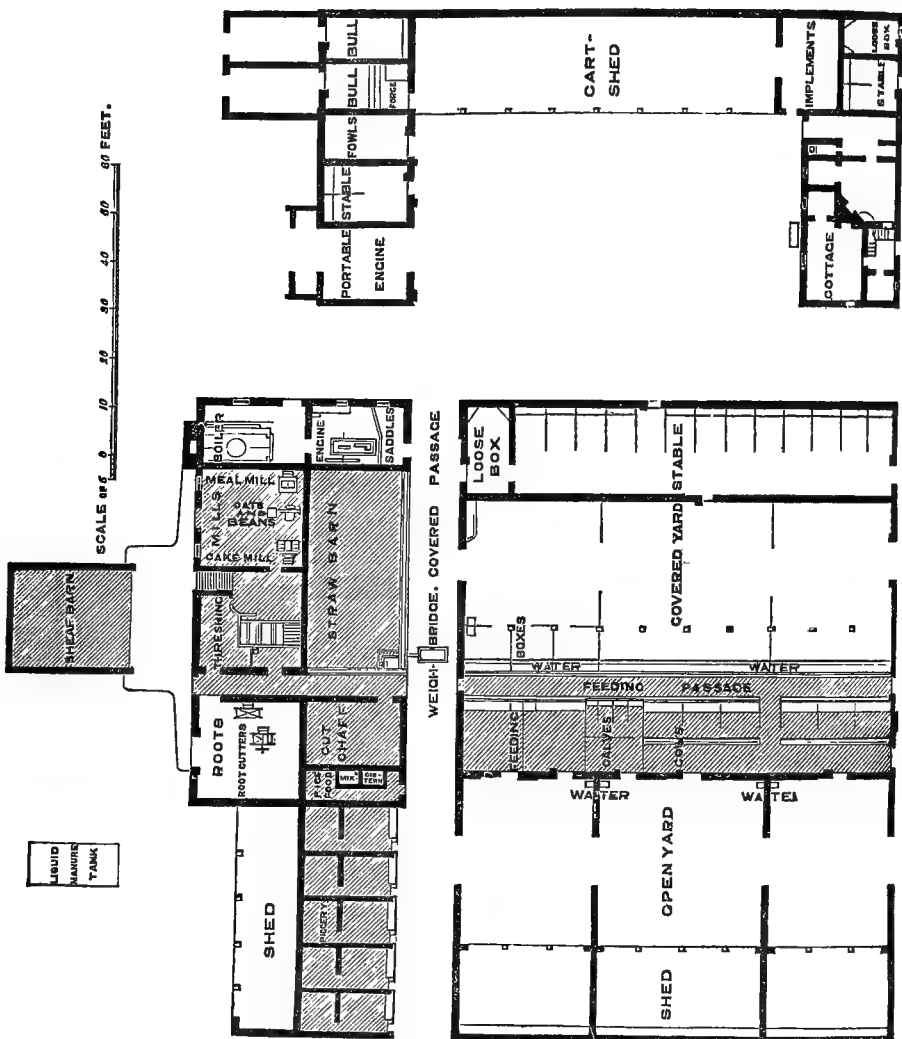
Fig. 16.—*Englefield Buildings.*



mission, from the 21st volume of the *Journal of the Agricultural Society of England*, where they are described by Mr. J. B. Spearing.

6. Of another method of developing the covered-yard principle,

Fig. 17.—*The Flemish Farmery.*



which is due to Mr. Wilkinson, architect, of Oxford, I give two illustrations. In all his buildings, the rick-yard is at one end, and

the threshing barn, straw-barn, granaries, and root-stores extend between it and the rest of the buildings along one side of a quadrangle, in which stables, covered yards, cow-houses, cattle-boxes, piggeries, to be supplied with litter and fodder from the stores close by, are arranged under a common roof. This is all shown in the drawing (Fig. 17), taken, by permission, from the 21st volume of the English Agricultural Society's Journal, in which the different parts of the farmery erected for H.R.H the Prince Consort, by J. R. Turnbull, Esq., architect, Office of Works, Windsor Castle, are designated. The Flemish farm to which it belongs contains 400 acres of very stiff soil, of which 240 are arable. The plan on the adjoining page (Fig. 17) shows all the details of the building, except the second story over the boiler and engine-rooms, which is occupied as a granary. The chaff and litter cutters (I am quoting from Mr. Spearing's report in the journal) are placed on a floor over the chaff-room and a portion of the straw-barn, so that the cut falls ready for use in the covered yards and stables.

As a further illustration of the general style of these buildings, I give the following elevations from the Agricultural Society's Journal, Fig. 18, being the elevation of granary, sheaf-house, and root-

Fig. 18.—Elevations of Flemish Farmery.



Fig. 19.



house, as seen from the reader's left of Fig. 17, and Fig. 19 giving the elevation of stable, covered yard, and cow-house, as seen from the reader's right.

7. The other illustrations of Mr. Wilkinson's covered yards are taken from Northbrook Farm, Kirtlington, near Oxford, the property of Sir G. Dashwood, Bart. On this farm there was already a considerable quantity of shedding and other buildings, available for many of the purposes of the farm; and Captain Dashwood, in whose hands the farm has for several years been, wisely resolved to retain

it all until a few years' experience should have fully determined the requirements of the land under its altered management; and accordingly it is only that part of a farmery required for the accommodation of the working and the feeding cattle that is new. The principle of covered yards, as here carried out, is thus perhaps more strikingly illustrated than where the attention of the spectator is drawn away by lofty barns, elaborate machinery, or any other more striking department of a complete set of farm buildings.

There is no better established truth in the theory of agriculture than that which makes all growth, whether of the animal or plant, to be an actual building up of the matter within reach of either available for its nutrition. It is this growth which is the whole business of the farmer; and it therefore tends greatly to his success if the process be carried out without waste—*i.e.*, if the food of animals be burned (for that is the proper word) as little as need be in their lungs; and if all the manure, which is the food of plants, be carried direct from the feeding-house where it is made, to the soil with which it is to be incorporated. To this end animals should be fed in warm and sheltered places, and dung should be made under cover. These are the two points for which special provision is made by covered yards for feeding stock. And at Northbrook, as at the Royal farm, the system is well carried out.

A central yard, thirty feet by ninety, somewhat excavated below the ground on either side of it, has a row of stabling for the farm horses on one side of it, and of piggeries, and cow-stalls, and cattle-boxes on the other side of it, along its whole length.

The stable contains stalls for fourteen horses, and the soiled litter from them is thrown into the covered yard on one side of it; while the dung from the piggeries and the cows and cattle is in like manner thrown into the central covered yard upon its other side. The dung from all sorts of cattle, whether in store or fattening condition, and however fed, is thus mingled together, and supplies a quantity of fertilizing matter of uniform quality made as well as it can be. It is trodden under foot and mixed with the litter, and the excrement, of a large number of heavy fattening oxen in the central yard—and suffering no injury whatever by the washing of rain, is in the best possible condition for fertilizing the land.

At the end of the stalls and piggeries on one side of the covered yard is the steaming-house, where cut straw of oats, and beans, and hay chaff, mixed with broken rape-cake, are steamed, and afterwards given along with cut roots to the live stock; and easy access is also given to cattle in open yards on the southern side of the buildings, provided with shedding which is part of the roofing of the general quadrangle. Light is provided from the roof; and the openings at either end are manageable by louver boards and windows, so as to regulate the ventilation. The roof of the central yard is also

higher than the rest, and ventilation and light are given through the side walls.

Fig. 20.—Kirtlington Farm Buildings.

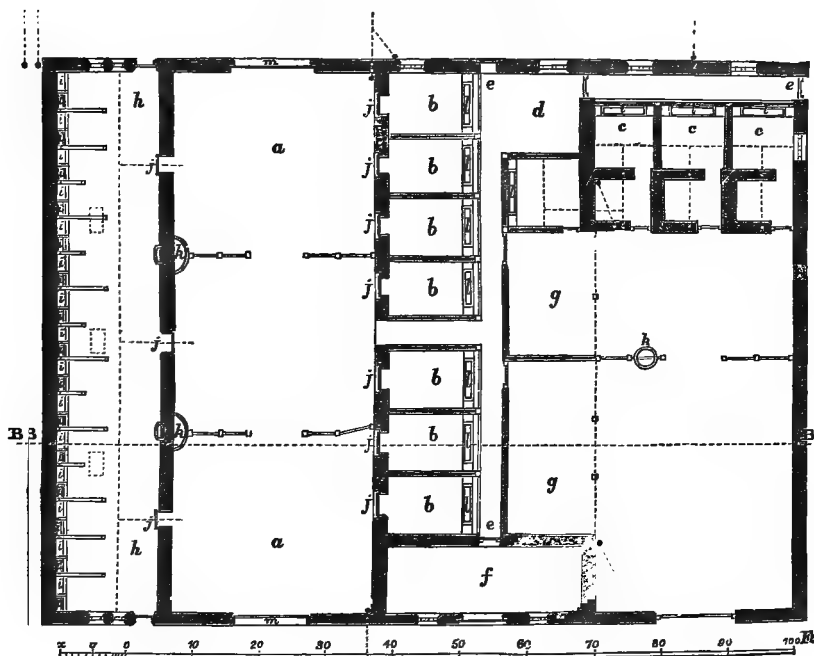


Fig. 20 is a plan of these buildings, and the following are references to the index letters:—

a, a, Central covered yard, divided into three. *b, b*, Cattle-boxes, stalls, or piggeries. *c*, Piggeries and sties. *d*, Food-house for pigs. *e, e*, Gangway. *f*, Steaming-house and food-house. *g*, Sheds and yards for young cattle. *h, h*, Stable. *i, i*, Mangers in horse-stalls. *j, j*, Doorways (also in Fig. 23) for passing soiled litter into central yard. *k*, Water-trough. *l*, Mangers and troughs for cows and pigs. The dotted lines indicate drainage, excepting the squares marked on the line of stabling, which indicate the position of the skylights.

Fig. 21.—Elevation of Kirtlington Farmery.



Fig. 21 is an elevation of the southern end of the buildings, representing in succession, from the reader's left to right, stable, central yard, with its gateway for the removal of dung, &c., steaming and food house, and open yards.

Fig. 22 represents a section of the whole building across the line B, B, on the plan at Fig. 20.

Fig. 22.—Section of *Kirtlington Farmery*.

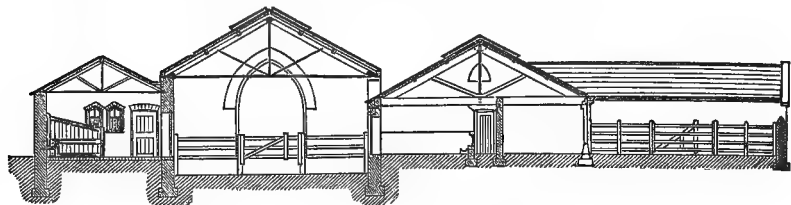


Fig. 23.—Section of *Stable*.

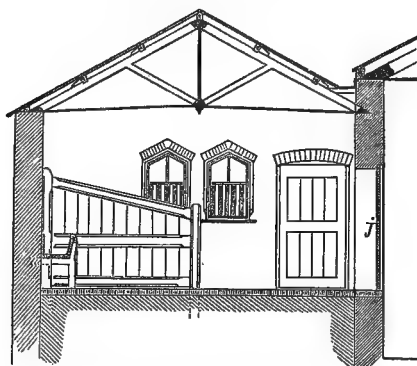


Fig. 23 represents a section, on a larger scale, of the stabling. This is a good illustration of economical and sufficient housing for the horses of the farm. Six-foot stalls, with ample gangway behind them, are provided with manger and rack; water is at hand in two or three troughs, at which the horses drink when coming in from work. Ventilation is provided in the simplest way, by an occasional ridge-tile being lifted out of the regular course, and bedded at either end upon its neighbours—the under boarding being there left open. And light, as already said, is provided from the roof by skylights, and by hanging lamps at night.

Illustrations have thus been given of seven sets of buildings erected for the efficient equipment of ordinary arable farms, and for the accommodation of cattle on the box-feeding, stall-feeding, hemel or open-yard, and covered-yard systems. It is no part of the plan of this book to instruct architects in the provision of all the necessary details of buildings for the farm. It has been thought advisable, however, to supply sufficient illustrations of the leading principles to be observed in designing such erections.

8. Perhaps it may be well to name, as one other instance of a good set of such buildings, those erected at Weston Birt, the seat of R. Holford, Esq., M.P., in Gloucestershire, where the home farm has been recently supplied with a capital farmery designed by Mr. E. Rich, the agent for the estate, in order to suit the requirements of a large establishment, as well as to meet the wants of a large farm. The main block is in ground plan a sort of trident, the middle prong being represented by a double row of roomy cattle boxes with a central gangway—one of the side prongs being a row of cart-stables, and the other being a row of cattle-stalls and shedding. The spaces between these lines are yards used for cattle. These three parallel rows of building thus separated are united by a cross-head of double sheds with a gangway between them—cattle sheds opening on the south into the yards just named on one side—and cart and implement sheds opening to the north and west on the other side. Over these latter are granaries. The handle of the trident, to maintain the comparison, is a range of building extending north, comprising most complete barn and steam-threshing and grinding machinery. And at the farther end lies a yard and saw-house, for which the same steampower is available, where carpenters' work for the estate is done.

The main road through the buildings lies across the points of the three teeth of this trident, to which the ground plan of the buildings has been compared. On its one side, and in the spaces between these points, at the ends therefore of the two yards, are pig-pits and piggeries; and on the other side lies the bailiff's house with admirable dairy, cottages, and yards and sheds for dairy cows. Provision is made for poultry in a separate set of houses on one side of the main block of buildings. The whole arrangement is very convenient and economical of labour, and the construction of the several parts is praiseworthy. In particular the adoption of such a plan as was adaptable to any method of feeding, either in yards, sheds, or boxes, is worthy of being copied.

There are several other points yet to be named which deserve mention in a paper on farm buildings.

a. The choice of site should be determined in accordance with the water supply and the aspect, as near the centre of the farm as possible.

b. In supplying power for the threshing of the grain and preparation of food it is perhaps better, now that moveable steam-engines are coming into such general use for cultivation as well as for threshing, to make provision for the standing of a locomotive engine which may be attached to fixed and other machinery, rather than to have a fixed engine.

c. Provision for the lighting of the buildings is now made in many Scottish farmeries by a small gaswork attached to the build-

ings, which is found to provide better light in a more economical manner than was done by the old stable lantern.

d. The selection of stall, box, or covered yard, as the guiding principle of the farmery, must be determined by the circumstances of the farm; but the last is undoubtedly the most generally useful, because a quadrangle once roofed in may be subsequently made available in any way. And the following experience, now ten years old, is confirmatory of the merits of the plan. It was quoted by Mr. Cook, of Holton Hall, some years ago, in a lecture before the Hadleigh Farmers' Club. His correspondent, an Essex agriculturist, then answered a number of questions as follows:—The dung made in the covered homestall is fit for immediate use. There is no drainage from the dung to render tanks necessary. There is no unpleasant smell during the time it is making. About the same straw is required for littering the cattle. The cattle are warmer and more protected than in open yards. They fatten quicker on that account. The consumption of food is less. The quality of the dung is a vast deal better. One-third less is used per acre, with better effect. The homestall is as useful for cattle during summer as in winter. I should like to have them on all my occupations, and I recommend them most strongly. They are useful for the temporary protection of hay and corn during a fickle harvest. The money value of the dung made in the covered homestall is nearly double that made in open yards.

e. On the relative merits of the box and stall-feeding plans, the following may suffice:—The principal advantage of the former is the economy of food and manure which it affords. The ox rests better while it is enabled to take that amount of exercise necessary to health; with proper treatment, it enjoys a purer atmosphere than in the stall, and is equally well sheltered from the inclemency of the weather, enjoying a more uniform temperature. It receives its food in quantity and quality as its size and constitution demand, and eats it without molestation or annoyance. We often see the ox standing or trying to stand across its stall, or hanging backwards as far as its chain will allow; and when lying, manifesting similar symptoms of uneasiness from which it is endeavouring to get relief.

In the feeding-box, on the other hand, the ox is enabled to take that amount of exercise which health demands.

Cleanliness is equally essential to health as exercise; and 15 to 20 lbs. of litter daily in the feeding-box will insure a dry and cleanly lair.

Ventilation and an equable temperature can be secured better in the feeding-box than in the stalls. The whole of the manure is preserved, the liquid is all absorbed, and is thus better conveyed to the ground than when draining into tanks, and requiring altered

management and new machines and extra labour for its conveyance to the crops.

f. Portable buildings have been often advocated, and may be defensible in cases where landlords refuse to erect sufficient buildings. The tenant would then have power to remove such erections at the end of the lease. The following are the considerations urged in defence of portable buildings by Mr. Barugh Almack in a letter to the English Agricultural Society (1852).

“If any one doubts the value of having farm buildings moveable, let him bear in mind what a saving of labour there would be, in some cases, by having portable cattle-boxes, &c., to take to one end of the farm, instead of bringing the turnips and straw, &c., from that end of the farm, and then taking them back again as manure. Unnecessary labour causes other labour that would not otherwise be necessary; for instance, unnecessary carting on roads causes labour in repairing them. By consuming the produce near to where it was grown, the saving in the cost of labour, and in the quality of the corn by harvesting it more rapidly, might be equal to the rent of the land.

“If horses had portable stables close by their work, they would lose less time in going to and from it, and thus be able to do more work in the same time. They could be comfortable in the stable close by when not wanted on the land, and they could be making the best manure by eating lucerne, tares, or whatever else was most likely to be profitable to grow close by, and the manure so made would be close by where it was wanted.

“I have no doubt it is quite practicable to make every necessary farm-building moveable; and in many cases I am quite certain that it would pay well to make part of them portable, now that there is a probability of an increasing scarcity of farm labourers.”

g. On the possibility of such portable buildings it is sufficient to say that they ought to be made so by the easy fitting and portability of their several parts, not by the whole being capable of being moved bodily on wheels. Any quantity of ground may be covered by a roof supported on wooden walls, in building which a certain number of grooved posts are used—receiving planks and carrying rafters and sheets of corrugated iron roofing—every part of each section being exactly like another, so that the whole can be taken down and unpacked, and carried away and replaced, without the drawing of a nail and with no need of any particular skill.

h. On the cost of the erection of a permanent farmery, and who should bear it, the following is the opinion of an experienced architect—Mr. Newlands, of Liverpool, as published in the *Agricultural Gazette* (1845).

The erection of a homestead is necessarily attended with great expense—an expense greater in proportion on small farms than on

those of larger extent ; and it too often arises that in the desire to lessen this expenditure, a landlord with injudicious parsimony will be found to curtail a tenant's accommodation, and probably withhold from him buildings essential to the conducting of his business ; or, with mistaken economy, he may be induced to construct the buildings without reference to strength and durability. On the other hand it may be that the tenant asks a greater extent of building than the wants of the farm demand ; or, to favour some passing peculiarity of his management, he may wish buildings provided which are not common in similar cases, and which, if erected, might prove useless to his successor, and very likely in a short time to himself. The prosperity of the tenant for the term of his lease in great measure depends on the sufficiency and completeness of the accommodation afforded by the homestead, and it is therefore essential that the buildings forming it should be designed with the requisite fitness for the farm, and constructed with good materials, and with strength to insure durability. But although a sufficient amount of accommodation ought always to be given, too great an extent of it is an evil. It tends to unsystematize the management of the farm ; it entails a large expenditure on the farmer for repairs, always grudgingly bestowed ; and the useless buildings are soon allowed to fall to ruin from neglect.

The cost of erecting buildings does not always devolve on the landlord. The burden is sometimes thrown upon the tenant—upon one whose interest in the matter not being permanent, like that of his landlord, may lead to the commission of the very errors we have just been deprecating. The injurious tendency of this system, however, must be apparent. But there is another error more common which needs animadversion—viz., requiring the tenant to carry the building materials. It is asserted in defence of this practice, that the tenant can at spare times lead forward the materials at less cost than any one, having the requisite vehicles, horses, and labourers, in his own employment. Granting this to be true, it is still diverting his attention, his capital, and energy, from their legitimate objects ; and that, too, at a time when they are most required—at the commencement of a lease. But the assertion is inaccurate ; farm vehicles are not fitted for the carriage of building materials ; so true is this, that where the operations are extensive, and the farmer has this burden laid upon him, it is a wise economy on his part to procure the proper vehicles. Valuable farm horses, too, are rendered valueless by labours for which they are unfitted ; and the same economy under the same circumstances teaches that it is wisdom to purchase cheap animals in addition to those for the farm, and dispose of them at whatever sacrifice when the work is done.

Further, the labours of the farm and those of the building can-

not proceed together; hence there are frequent stoppages of the one, or no less injurious interruptions of the other. Thus, no saving can result from this system, but, on the contrary, evil to all parties. The burden imposed on the tenant, of carrying the materials, should not be regarded as lessening the cost of the buildings, but as a payment, in another form, of his share of the cost; and in point of fact it forms part of the bargain of the lease.

The cost of erecting farm buildings, then, should devolve on the landlord, but the expense of keeping them in repair properly falls on the tenant. It is a good arrangement to appoint a properly qualified person to make periodical examinations of the buildings of an estate, to see that this condition is strictly complied with. The neglect of a trifling reparation, at the proper time, may lead to serious damage; and such negligence the vigilance of an inspection will prevent.

III.—PEAS.

This is the season for sowing the hardy sorts of pea; and towards the end of the month any kind of field pea may be sown. The pea can hardly be called an ameliorating crop, but admitting of cultivation in the wide intervals between the rows in which it is usually sown, and afterwards covering the ground with a bulky smothering growth of haulm, it is when well cultivated a fallow crop. The land should thus be left cleaner after peas than it was; and as the crop yields in its nutritious straw a capital contribution to the dung heap, a frequent crop of peas is no evidence of cross-cropping. It rarely, however, forms a regular part of the rotation, being taken now and then, in addition to the common course of cropping, when the land seems fit for it, or unfit for the crop which it is taken to displace.

The soils best adapted for it are the lighter loams which are hardly stiff enough for beans; and calcareous soils are especially fitted for it. Pea straw contains in its ashes from thirty-five to forty per cent. of lime, and twelve to fifteen per cent. of potash. This indicates the kind of soil which the plant requires. Peas need liberal treatment and good cultivation like any other crop, but bad farmers are too apt to sow this pulse when the land will yield nothing else. They have a proverb among them, which signifies, that the season does for peas as much as good husbandry; and they from thence take care that good crops shall be owing to season alone. Hence arises the general idea of peas being the most uncertain crop. This is owing to their being too often sown on land that is not in good order. Let the careful husbandman lay it down as a maxim, that he should sow no crop on land that is not in good order; not merely in respect of fine tilth at the time of sowing,

but also of the soil being in good heart and clear of weeds. I would not, however, here be understood to rank all kinds of crops together; because beans and peas will admit of cleaning while they grow. On that account, if a farmer comes to a field which his predecessor has filled with weeds, a horse-hoed crop of beans might be expedient, when a barley crop would be utterly improper. Peas, when managed in a spirited manner, will not have the reputation of being so very uncertain a crop, for this character has, in some measure, been owing to ill conduct.

From these remarks, however, the reader is not to understand that I think peas as certain as other crops; but this quality will still much depend on management.

Peas after Clover.—The white boiling pea, of many sorts, and under various names, is more tender than the greys and various kinds of hog peas; but I have many times put them into the ground in February, and though very smart frosts followed, they received no injury. I have uniformly found, that the earlier they were sown the better. There is also a particular motive for being as early as possible; which is, to get them off in time for stubble turnips: If they are sown in this month, and a right sort chosen, they will be off the land early in July, so that turnips may follow, at not too late a time for sowing that crop. All the sorts of early peas should be cultivated on dry soils only. Upon sands, dry sandy loams, gravels, and chalks, they succeed well.

Broad-cast peas are to be utterly rejected in every case. The only question that can arise in their culture is between drilling and dibbling. If the former is determined on, the land should have been ploughed in autumn, with the skim-coulter. The surface being worked shallow with a scarifier and harrow as soon as possible after winter, drilling should directly follow. If dibbling is determined on, the land, if already clean, need not be ploughed till winter time or after it, and a heavy roller follows the plough. Dibbling peas on a clover layer generally results in a good crop.

It is the practice of some farmers to manure for peas. If the land is in heart, and they are put in on a layer, they do not want manure. A very good crop may be gained without it. I have had five, and even five quarters and a half an acre, without any manure applied for this crop. Dung makes them run to long straw, and that is not favourable for podding productively. Beans will benefit from a heavy dressing of dung, but with peas the case is different. There are very few situations in which the farmer can have such a command of manure as to give him a sufficiency. It is therefore of much consequence to him never to spread a load but where it will be sure to answer best. Every man complains of a want of dung; and he should be careful therefore to give it to the crops that will pay best for the expense.

As to distance between the rows of peas the practice of various farmers differs exceedingly. Equidistant rows from nine to eighteen inches are common. I have seen them at two feet, and even at three. In dibbling, it is common in Norfolk and Suffolk, to put in a row on every flag or furrow-slice of nine or ten inches breadth; and I have known very good crops in most of these distances. If horse-hoeing, or much hand hoeing is intended, double rows at nine inches, with intervals of eighteen, do well; but the greatest crops I have known have been from planting every furrow-slice. Where drilled in rows, the interval of fifteen to eighteen inches is to be preferred. This enables an efficient horse-hoeing of the land during the early stages of their growth.

From two to two bushels and a half per acre is the usual quantity when planting every furrow. If they are drilled at greater distances, six or seven pecks will do. Some have trusted to one bushel per acre, but that quantity is too small.

Peas after a stubble crop—are sown by the drill after the harrow upon land which was cleaned, manured, and ploughed the previous autumn. The manure thus lying some months in the ground becomes more thoroughly incorporated with the soil; and is less likely to produce too gross and leafy a growth. The sorts sown may be (1) the early *grey Warwick*, which, however, being of more rapid growth, is adapted for March or later sowing; it is not so productive as other sorts, and is especially adapted for late districts and land in good condition; (2) the *common grey field pea*, later, more prolific, yielding a very bulky straw, and better adapted therefore for dry soils and districts, and for land not in such rich condition; (3) the *partridge pea*, or *grey maple*, very prolific, yielding plenty of straw, and better adapted than the last for a late country; (4) the *winter field pea*—referred to in autumn, when it is sown. There are also several white boiling peas adapted for field culture which may be named, as (5) the *early Charlton*, of medium bulk as to straw, yielding an abundant crop and tolerably early; (6) the *Carolina pea*, later, equally abundant; (7) the *white sickle*, a good cropper, yielding long bent pods, but much later than the others.

The place of the crop in the rotation is either after clover, as already named, or after a corn stubble; and in the latter case it generally takes either the place of clover in cases where there is believed to be a liability to "clover sickness," or the place of turnips in cases where there is believed to be a liability to the "finger and toe" disease.

After autumn culture as already described, the land as soon as dry in February, is either scarified or merely well harrowed down, and the seed, two to three bushels per acre, is drilled in rows, fifteen to eighteen inches apart, permitting the subsequent use of

the horse-hoe. The ground is then again harrowed and the field is shut up till the rows appear.

IV.—BEAN CULTURE.

Early in this month the farmer should begin to plant his beans, and, if possible, finish it before the end of the month, as later crops do not succeed so well. The land ought to have been cleansed, manured, and ploughed the autumn before; by which means the only object now will be to sow the seed. When cultivated in rows, twenty to twenty-six inches apart, and therefore allowing of the cultivation of the land during its growth, the bean is a fallow crop; *i.e.* it tends to clean the land, and to lay it open to “atmospheric influence.” And where it is grown that its produce may be consumed on the farm, it may be considered in every respect as a fallow or restorative crop, and may be allowed to take the same place in the rotation as the turnip or any other green crop. When however, it is grown for the *sale* of its produce, excepting on those lands which are peculiarly adapted for it, it should take the place of a corn or scouring crop in the rotation.

The soil which the bean prefers is a stiffish loam. There are many ways of cultivating the plant, but the best plan is either to drill or to dibble it.

1. When the land was manured in the autumn, as described in October and November, the field, lying all winter in the land in which it has been ploughed, will now harrow down, and the drill following will sow two or three bushels per acre, in rows two feet apart.

2. If the land has not been manured in autumn, it may have been well to rib it up in ridgelets two feet wide, or thereabout. The manure is carried on as soon as possible after winter, spread in the rows, and a bean barrow going up each row drops the seed over the manure, and the whole is covered up by the splitting of the intervening ridgelets with the double-mould-board plough. The new ridgelets covering the seed are afterwards partly harrowed down before the young plants appear.

This is the plan generally adopted in Scotland; and I add the following description, written a few years ago, of an actual day's work in February on a Galloway farm:—“We are now occupied with bean sowing, which is performed in the following manner:—The land, which was trench-ploughed in autumn, from exposure to the weather now breaks down before the drill plough, without any other previous operation; six drill ploughs, following each other, go a ‘bout’ in the morning, making twelve drills; a drill barrow, which sows three drills, then enters, and at a ‘bout’ finishes six drills. By this time the six ploughs have again drawn six drills,

and on returning up the field, they cover the first six drills, now sown. They then draw off six new drills, and again cover six on their return, the drill barrow going at the same rate, and sowing at a 'bout' six drills also. A space of twelve drills is left between the opening and covering, which gives plenty of room for the working of the barrow and the passing of the horses. The drills are twenty-seven inches wide, and are made across the winter furrows. Part of the land was dunged on the stubble, but the part* which was not dunged is dressed with three cwt. of guano per acre, sown in the drills by hand, and covered in with the seed. Two and a-half bushels of beans are sown per acre, and with this force we get over from ten to twelve acres a day. An expeditious plan at this season is of the greatest consequence, in taking advantage of a favourable seed time for beans."

3. Or, thirdly, if the manure be spread broad-cast, it is not an uncommon practice to plough in the seed, a bean barrow following every second or third plough, as they turn the manure under. The young plants thus come up in scattered rows, at intervals of eighteen or twenty-seven inches, giving ample opportunity for horse-hoeing.

4. Lastly, beans are often hoed or dibbled in: the former operation costs about 6s. per acre. The seed is planted across the ridges in rows about twelve inches apart; the labourer in the act of making each trench with his hoe fills the one already made, in which he has previously scattered a quantity of seed. Beans are sometimes dibbled: either the unharrowed furrow slice is used as the labourer's guide, and two or three beans are put into each of the dibble holes, which are made in alternate furrows, or, what is better, the land is first harrowed down, and a double line is used, the cords of which are ten or twelve inches apart, and the labourer facing them manages both rows at once. He makes in succession about four holes in the near line, and places seed in them; and after doing the same on the far line, he moves sideways up the rows and repeats the operation. The holes are filled in by a subsequent harrowing. Two to three bushels of seed are thus used, and about 5s. per acre are paid for it.

Soil for Beans.—Everybody knows that all the sorts of strong and heavy soils are the common ones generally applied to this crop. The winter bean, sown in autumn (see October), is alone adapted to the lighter class of soils. Chemists tell us that the ashes of bean straw contain no less than twenty-one per cent. of potash, and an equal quantity of lime. The mineral part of the grain is also remarkable for the quantity (forty-two per cent.) of potash which it contains. And this seems to indicate what is, indeed, plain from experience, that clays which are richer than lighter soils in alkaline matters, and especially calcareous clays, are well adapted to the cultivation of this crop. The place of the plant in the rotation is

* Guano and other artificial manures are of little use to beans.

that of a manured fallow crop, coming after other grain, and preceding a grain crop, generally wheat. Artificial manures are of little use to the bean crop; as much of the manure of the farm as can be spared is ploughed in for it either in autumn, or as soon as possible after winter. And Mr. Lawes recommends that the richer part of the farm-yard dung be kept for other crops which need it more. "Beans and tares," he says, "may be manured with the inferior qualities of dung."

Of the sorts of beans we name—(1) the *Winter* bean, a small oblong kind—two bushels containing seed enough per acre—weighing very well, often seventy lbs. per bushel, adapted for light soils, and hardy enough for autumn sowing. (2) The *common horse* bean, a good deal larger, needing two to three bushels or more as the seeding of an acre, and requiring to be sown in spring on stiff soils. (3) The *common tick* bean—much smaller—very prolific, two bushels containing seed enough per acre. (4) *Heligoland* bean, a plump, round seed, adapted for good soils; not so large as the horse bean; two bushels or ten pecks containing seed enough for an acre. (5) *Long pod*—a name for many different sorts, all of them much larger than those already named, requiring fertile land, in good order, for their efficient culture. (6) *Mazagan*, also as much of a garden bean as the long pod, but yielding a valuable produce per acre in fields well cultivated and in good condition.

V.—OATS.

Oats may now be sown, the later sorts at once, on any land which has grown a manured or fallow-restorative crop during the previous year, and has since been ploughed. In Scotland, the common place in the rotation for the oat crop is after a grass or clover layer. In England, such a place is always kept for the wheat crop; and oats follow either mangold wurzel and other green crops, pulled and carried from the land, or turnips sometimes which have been fed on the land, or a corn crop—as in the Cotteswold district, where it sometimes follows wheat.

In the fen districts it sometimes comes after rape or clover, and is followed by wheat. The oat crop is more largely cultivated in the North than in England. It is a hardier grain, and will ripen under circumstances where wheat would hardly attain maturity. According to the most recent agricultural statistics of the island, it appears that of the 152 plots of 100,000 acres each, of which English arable land consists, 38 are in wheat, 26 are in barley, 13 are in oats, 7 are in beans or peas, 23 are in turnips, 28 are in clover and grass, 9 are in bare fallow, and the remainder potatoes, vetches, mangold wurzels, &c.

In Scotland, again, of 35 such plots of 100,000 acres each, $2\frac{1}{2}$

were in wheat, $1\frac{1}{2}$ in barley, no fewer than 9 in oats, $\frac{1}{2}$ in beans and pease, $4\frac{1}{4}$ in turnips, $1\frac{1}{2}$ in potatoes, $14\frac{3}{4}$ in grass, and the rest in other crops of less importance.

It is from Scotland accordingly, where the relative importance of the crop is so much greater, that we learn almost all we know of the relative merits of the different sorts of oat in cultivation.

The cultivation of the oat consists in harrowing down the lea furrow or the ploughed land, whatever may have been the previous crop, and drilling in rows nine to twelve inches apart, about three to four bushels per acre, according to the kind that is chosen. Where clover has been ploughed with the skim-coulter, and followed by the drill-presser, and left for some weeks until thoroughly consolidated, oats may be very well sown broadcast over the land without any previous harrowing. It falls between the ribs left by the presser, and being well harrowed down, it comes up in rows.

The sorts of oat in cultivation are exceedingly numerous. An enumeration of them, with illustrations, will be given next month. Meanwhile, as especially adapted for sowing this month, the Tartarian and late Angus oats may be named; the former, whether black or white, are recognisable by the one-sided head and thin awny grain, weighing thirty-eight to forty lbs. per bushel, and needing at least one-third more seed per acre than many stouter smaller kinds; yielding also a bulky straw, and a great quantity of grain: the latter yielding a better quality of grain, and a tall up-standing straw, and valuable for its property of resisting wind at harvest time better than most other sorts, and well adapted for early sowing, especially on clay soils in early districts. Reference will be again made to the oat crop next month.

In accordance with the *resumé* of farm operations at the head of this month, I add here remarks on the Barley crop, though it is more particularly discussed in March.

Barley is more generally sown in March, but preparation must be made for its seed time by ploughing close up behind the sheep as they are folded on the turnips, whenever the land is dry enough. At a recent (1861) meeting of the Winfrith Farmers' Club (Dorsetshire), it was the universal testimony that early sowing was good policy. Illustrations will be given of some of the principal varieties of this grain next month; meanwhile I give the following enumeration of some of them, as described on the occasion just referred to by Mr. Randal, a member of the Winfrith Farmers' Club.

The *Common*, or *Early English* barley is the one most commonly cultivated through the kingdom; and although from time to time many other varieties have been introduced, it still maintains its position. It is suitable for light lands where the practice of sheep-folding prevails, and also for a greater range of soils than many other varieties; it has the advantage of coming to maturity earlier,

requiring only from fourteen to sixteen weeks to perfect its growth. For light lands of inferior descriptions this barley appears better adapted than any other kind ; and even on cold clay soils its early maturity and free manner of growing give it a decided superiority over those varieties which, although of finer quality, are of much slower growth ; it also works very well in the malthouse. The *Chevalier* barley is a great favourite with the maltster, and on good barley land answers the farmer's purpose very well ; but it is not in every district that so many bushels per acre of it can be grown as of the coarser varieties. It must be sown rather earlier in the season, as it requires a longer time to ripen than some of the more common sorts. The *Leghorn* barley is a good sort, very fairly productive, and a good malting barley, and it is often worth several shillings per quarter more than the coarser barleys. The *Annat* barley is one obtaining now a very wide reputation ; but has not attained the celebrity of the *Chevalier* for malting purposes. It is very productive on sandy loams. The *Nottingham* barley makes a fine sample, but it is also considered coarse ; it is generally of a good colour, and works well in the malthouse, and is sown rather largely in the north of England. The *Pomeranian*, or German barley, is a sort introduced from the Continent, and cultivated successfully in the North ; it is hardy, early, and generally productive ; the straw is tall and strong, the ear long and open, the grain of good colour, and weighs well, generally forming a good sample, and is considered a good sort for cold soils and late districts. There is a sort called the *Norfolk Shortneck*, which is spoken of as being very suitable for high and exposed situations. It has a long and tough straw, compact ear, with long and strong awns attached, and generally produces a sample good in quantity as well as in quality. There is also a very useful barley called the *July* barley ; it can be sown later than any other sorts ; it is suitable for all barley soils, yields well, and is a good sample for the maltster. There are also several coarser varieties of barley or bere sown for feeding purposes, hardier than the better qualities of this grain.

In the cultivation of barley, one great object to be attained before sowing it is to have the land perfectly clean and dry ; and when barley follows the turnip crop it is well immediately after the turnips are fed off, either to put a scarifier across the field or to plough it very shallow, for by so doing we get the sheep-droppings more intimately mixed with the soil, and also prevent the dung being washed away by the rain, especially in the hilly districts. Shallow or thin ploughing for the barley crop, is considered beneficial to the growth of clovers, which, like wheat, thrive and stand the winter better on a firm subsoil. In most rotations of crops, barley follows the turnip crop, and is succeeded by clover. If the turnip crop, to which a liberal amount of artificial manures has been given, is all fed off on

the land, and the soil be further enriched by oil cake or corn given to the sheep, the land may be sometimes left in too high condition, and the barley will grow too luxuriantly, and be laid, and the consequence is a very inferior sample of corn, and most likely the clover plant killed. To remedy this, a certain proportion of the turnips should be pulled and carted away for feeding elsewhere. Sufficient attention is not always paid to seed barleys,—the temptation of the higher price often takes all the best grain of the farm to the market, and the farmer then contents himself with sowing the best tailing. The seed ought to be of the best quality, fully matured, quite free from injury, and true in its variety. In sowing it some use the Suffolk drill, others prefer the old-fashioned plan of sowing broadcast. The drill is to be preferred, as it not only deposits the seed at an uniform depth, but also puts it out of the way of the birds, and effects a considerable saving in the quantity of seed required. Very early in the season three bushels per acre, or even less, is quite sufficient; but, as the season advances, a small addition to the quantity is required.

Mr. Randal, from whose paper on this subject the above remarks are taken, adds, "The early-sown barley is always the best. I think we ought, if possible, to get the greater part of it in in the month of March, the earlier in the month the better; even the last week in February, if our hill land will work free, I do not think too early to begin sowing."

And this opinion was expressed by others:—

Mr. Reader thought that where the general practice was to use large quantities of artificial manures for the root crop, and those roots fed off on the land, it was desirable the barley should be sown early—in February if the land would work well. He had always found early sown produce a larger quantity of corn, and of a very superior quality, and the straw of late sown was generally weak, consequently was often laid down, and injured very much the clover plant, which was a great consideration.

Mr. Meade stated, with regard to the time of sowing barley, that the sooner it was done the better. He had once sown some in January, $2\frac{1}{2}$ bushels per acre, and farther on in the season had sown the remainder of the field, 3 bushels per acre. At harvest he found the earliest sown much thicker on the ground, a larger quantity of corn, and a very much better quality.

The Chairman had never known late sowing of barley to produce a good crop; the quantity of straw would be very great, but the produce of grain was never nearly so good as early-sown corn.

Barley on Fallow.—In some districts of heavy land it is the common practice to sow barley on a summer fallow; it is particularly so in Essex. There the farmers have long been accustomed to plough their fallows in August or September, on two-bout ridges,

i.e. of four furrows each, of about three feet breadth ; if in August, some will reverse the ridges immediately after wheat sowing, others before it. They water grip the field well, and in February plough and sow, still on the same ridge, but harrowed nearly flat, by harrows made for the purpose. If they have a dry season to plough and sow, they get good crops, but much ever depends on this in spring tillage of clay lands, especially if imperfectly drained. To lay their lands in such form as to admit the scarifier and drill, the horses walking only in the furrows, and to avoid any spring ploughing, is necessary on undrained soils, and attended with success; but the better plan is to thorough-drain the land, and then treat it like the rest.

Spring wheats may be sown this month on any land adapted to them, either clover lea which has not been ploughed in time for an earlier sowing, or land which has borne a green crop—either pulled and carried away or fed on the land by sheep. The Talavera wheat is one of the best for sowing at this time—though almost any of the sorts usually sown in autumn will do very well. Later in the season the so called April wheat, a red-bearded sort, is alone fit for use as seed, and a description of it will accordingly be given next month.

The present is the best time of the year for top dressings of wheat with half soluble manures, as guano, soot, rape cake, &c., and two or three cwts. of the first, thirty or forty bushels of the second, and four or five cwts. of the third, are a sufficient dressing per acre. It ought to be harrowed in as soon as possible. The more soluble manures, as nitrate of soda and sulphate of ammonia, are better sown somewhat later in the season, when growth is more active and will more rapidly make use of what is within its reach. To this subject reference will be made in March.

Vetches to come into use for feeding during July may be sown now, as much as are likely to be wanted in that month. Three bushels per acre on any manured land of a clayey soil, are sown in rows eight inches or thereabouts apart, and will yield very valuable food for sheep and cattle, and be cleared away in time for a crop of good stubble turnips.

Sainfoin, too, may be sown towards the end of this month, though it is more usually sown in March, when its cultivation is described.

Seed beds for cabbages and kohl rabi should be sown this month for transplanting in May into the fields where they are to be grown. The seed bed should have been cleaned and manured and dug in autumn. Three or four ounces of seed should be sown on each square perch of the prepared nursery, well raked in, and then a peck of soot sown over each rod. A cabbage nursery cannot be too good, nor can too much care be taken to have strong plants, by afterwards thinning carefully. The Drumhead cabbage is the best sort for sowing at this season. And either the green or the purple

variety of the kohl rabi may be chosen, if it be desired to try this crop. (See March.)

Potatoes are sometimes planted as early as February; but next month is the more ordinary season of planting in the field culture of this crop. It is right to plant early, to choose early sorts, and to plant them in early soils, in order to have reached maturity before the time when the potato disease usually appears. If the land intended for them were not cleaned and manured, and deeply ploughed before winter, it may be well to plough the land this month, provided the weather be dry enough; but in preparation for this, as well as for all other crops, no ploughing should go on while the soil is at all wet.

VI. PARSNIPS.

Parsnips sown in February on rich loamy soil, will repay cultivation; but they demand a better soil than almost any other crop; and if the farmer has not land of extraordinary quality, he had better not venture on their culture. They love a very deep, rich, dry, sound, friable, sandy loam, ploughed as deeply as possible towards the end of autumn, and left for the frost to pulverize and sweeten. About the middle of February, if the weather be favourable, it will be proper to roll heavily and then sow and harrow in five or six pounds of seed per acre, in rows twelve or fifteen inches apart; and they will come up in about six weeks.

If the land is liable to grow small surface weeds, which will bury the young plants, some turnip seed, or a few grains of oats and barley should be sown with the parsnip. They will spring first, and show the position of the future row, and so enable the use of the hoe for keeping down intruders before the parsnip plant appears.

The parsnip, on ordinary soils, is far out-distanced by the Belgian carrot, the mangold wurzel, and other root crops for cattle, sheep, or pigs; but on rich parsnip soils, this root is undoubtedly both productive and remarkably nutritive; and I here reproduce, somewhat shortened, the statement given on this subject in the earlier editions of this book, by Mr. Budd, a correspondent of the Society of Arts. His report referred to the produce of one acre of parsnips. He said:—

“In the first place, I put up sixteen hogs a fattening upon them, throwing the parsnips on the ground whole. This I continued for about a month, when I observed they did not go on so well with them as at first. Upon this I boiled the parsnips, and made wash of them; thickening the wash with half a bushel of barley-meal every day, giving it in a trough; and I continued this method for two months, when I killed the hogs, and

found them to be very good meat, weighing from twenty-eight to thirty-three stone per hog, and worth in all 52*l.* 17*s.* 4*d.* The barley-meal cost 3*l.* 18*s.* 9*d.*; the fuel, 1*l.* 10*s.*; attendance, 2*l.* 5*s.*; which sums, added to the expenses attending the parsnips, prime cost of the hogs, &c., amount in the whole to 35*l.*; so that my profit upon this article only, is 17*l.* 16*s.* 8*d.*, which remains to be carried to the account of the parsnips. After my hogs were killed, I kept four dairy cows upon the remainder of the parsnips for three months, which, at 1*s.* 6*d.* per week, amounted to 3*l.* 12*s.*; and this sum, added to the 17*l.* 16*s.* 8*d.*, before mentioned, makes the nett profit on the one acre of parsnips to be 21*l.* 8*s.* 8*d.*

"I must observe, that giving my dairy cows the parsnips answered my purpose greatly, by increasing their milk, and making the butter much richer and finer than turnips or carrots, which I had given them long before. The manner in which I gave the parsnips was, cutting them in pieces."

Mr. Budd's experience was a very unusual one. A good ordinary crop of the large Jersey parsnip may be ten to twelve tons per acre; and it is not generally worth, as food per acre, so much as the Belgian carrot or the mangold wurzel.

Grass lands receive the same management this month as during January. Thoroughly dry pastures may be set apart for the ewes and lambs, which will receive cut roots and hay in troughs in the field. Water meadows are still treated as during winter, being flooded at intervals during February. If manure has not before been carried on to fields intended to be mown for hay, it may still be done in February during dry weather. And artificial manure may be applied, such as superphosphate of lime, and mixtures of it with guano, and with other mineral manures. On this subject see remarks in March.

VII. — THE FEEDING-HOUSE AND COW-BYRE.

Cows are, many of them, about to calve. They should be suffered to run dry six or eight weeks before calving time; and are kept in fair condition on chaff of hay and straw, with a limited allowance of roots; or the roots are pulped, and the chaff is mixed with them a day before use. The whole acquires some heat from fermentation, and is more palatable and nutritious. As soon as they have calves, they are placed in the warmest yards, and put on a more liberal allowance of roots, either pulped or steamed, along with the best hay the farm affords. And it is a good thing to give them an allowance of bean-meal in their water.

The management of the Calf was referred to in January. It may be added here, that in the Gloucestershire dairy districts, the calf is removed from the cow at six or eight days old, provided the

dam be a cow, and not a heifer ; but if a heifer, the calf is allowed to remain about a fortnight, as the calf renders her easier to milk afterwards. At about a week old, calves are allowed each two quarts of the new milk twice a day. Nothing else is given till they are about two months old, except hay, which they generally eat well at a very early age, say three weeks. After two months old they consume a good quantity of hay, and then the two quarts of milk are reduced to one, and two quarts of water are added, which make a mixture of three quarts, as of course they require more to drink when they eat so much hay. At about ten weeks old they are turned to grass, and the milk is discontinued by degrees. It is not desirable that the heifer should suckle her first calf except for the limited period just mentioned ; she should be made quiet for milking as soon as possible, and this object is defeated by allowing the calf to suck. The weaning of calves on skim-milk was alluded to at page 47. The practice prevalent in Berwickshire, where large numbers on every farm are reared and fed to come out as beef at two years old and upwards, is thus described by Mr. Wilson, of Edington Mains.

“ It is desirable to have all the cows to calve between February 1 and April 1. If earlier, they will get almost dry ere the grass comes, and calves later than this will scarcely be fit for sale with the rest of the lot. When a calf is dropped, it is immediately removed from its dam, rubbed dry with a coarse cloth or wisp of straw, and then placed in a crib in the calf-house among dry straw, where it receives a portion of its own mother's first milk. For a fortnight new milk is the only food suitable for it, and of this it should receive a liberal allowance twice a day ; but means should after this be used to train it to eat linseed cake and sliced Swedish turnips ; and the readiest way to do so is to put a bit of cake into its mouth immediately after getting its milk, as it will then suck greedily at anything it can get hold of. By repeating this a few times, and placing a few pieces in its trough, it will usually take to this food freely ; and whenever this is the case, it should have as much as it can take, so that its allowance of milk may be diminished to meet the necessities of the younger calves which are coming in succession. This is of the greater importance that it is always most desirable to avoid mixing anything with their milk by way of helping the quantity. When a substitute must be resorted to, oatmeal porridge, mixed with the new milk, is perhaps the best. The sour smell invariably found in the calf-house when porridge, or jelly of any kind, is mixed with the milk, is proof sufficient that indigestion is the consequence. An egg put into each calf's allowance, and mixed with the milk by stirring with the hand, is a good help, and never does harm ; but, with this exception, it is best to give milk warm and unadulterated, however small the quantity ; and along with this dry farinaceous

food, turnips and hay *ad lib.* If more liquid be needed, a pail with water may be put within their reach, as this does not produce the bad effects of mixed milk. Indeed, it is best to keep as closely as possible to the natural arrangement according to which the calf takes its suck at first frequently, and then at longer intervals, as it becomes able to eat of the same food as its dam. The diet of the cows at this season is a matter of some consequence. Swedish turnips yield the richest milk, but it is too scanty, and calves fed on it are liable to inflammatory attacks. Globe turnips should, therefore, form their principal food during the spring months. Care should also have been taken that they do not get too low in condition in the autumn and winter; and for this end it is well to put them dry at least three months before calving. Some may think this long; but on a breeding farm milk is of little value at this season. The cows, when dry, are kept at less expense, and by this period of rest their constitution is invigorated, greater justice done to the fœtus now rapidly advancing to maturity, and so much more milk obtained after calving, when it is really valuable.

Fatting beasts in boxes, stalls, and covered and open yards, continue to receive their allowance of cake or meal, with cut or pulped or steamed roots and chaff. The main points to be attended to are to keep them well supplied with litter, and to be regular in giving them the requisite quantities and kinds of clean food in a clean place. (See *Calendar* in November.) They will be sold during early spring, as they become ready for the butcher.

Cattle in store condition, whether young heifers, which will be put to the bull the ensuing summer, or young steers, which should be grazed during the summer, and afterwards fed during the following winter to be fit for the butcher at two years old, should have a sufficient supply of roots, either cut or pulped, along with chaff of hay and oat or bean-straw mixed. One or two lbs. a head of oat-cake along with this food will generally be repaid.

VIII.—THE SHEEPFOLD.

The Lambing season has now commenced on all low-land farms; and the constant care and attention of the shepherd is now required. Reference is made to the treatment of a lambing flock in the case of early lambs at page 50.

By way of marking the contrast which obtains between the management of a Highland sheep farm and that proper for February in lowland England, I again quote from the Lammermoor sheep farm, mentioned at page 55.

"Lammermoor Sheep Farm, Feb. 5.—From the effects of the hard frost on the pastures, the sheep are beginning to lose condition, though they are still good for this time of the year. Towards the

end of this month the leanest of ewes will be brought in, and get a moderate allowance of turnips daily. With the exception of a few of the weakest, none of the hogs get turnips during winter, and they are not kept in a separate hirsle, but allowed to graze with the ewes. Two advantages are gained by this. The lambs, when weaned, being only kept from the ewes for about twelve days, when let back to them again generally recognise their own mothers, and continue to follow them during the winter, the ewe scraping the snow and leading to shelter during storms. But the greatest advantage is, that since this plan was adopted there has been comparatively little loss from 'sickness,' an epidemic which, on some farms, in particular seasons, carried off nearly the whole of the young sheep. In some measure to compensate for the want of turnips, all the hogs of both breeds have a flannel jacket, twenty-two inches long and sixteen broad, sewed along their backs, to keep them warm and dry during cold, wet weather. This plan, as far as we are aware, is only adopted on another farm in this district. Though unsightly at the time, we are convinced that it is of great benefit, doing away with the necessity for smearing with tar, affording more protection to the animal, and greatly improving instead of injuring the fleece. The jackets are put on during the latter end of November, a few days after they are bathed.

"*Feb. 24.*—At this season hill pastures, being deadened by frosts and bleached with rain, are at their worst, just when the additional demands made on the ewes, which are now heavy with lamb, would require a supply of more nourishing food. Quiet, fresh weather compensates greatly for the want of better food. 'The moss,' or hare's-tail cotton-grass, has been in perfection; and on all grounds where this valuable plant abounds, the sheep are in nearly as good condition as they were three months ago. There is much, however, between the cup and the lip. Yesterday was fine, the ground actually showing symptoms of spring, and our summer visitors, the plovers and curlews, making their appearance, when this day opened with three inches of snow on the ground, and the appearance of severe frosts. Such of the turnips as had escaped the effects of January's frosts have been stored for the use of the Cheviot ewes during March and April. The young sheep were put on turnips on the 22nd, and will continue to receive about one cart-load to 100 sheep, until the lambing has fairly commenced. The old ewes will begin to receive a few about the middle of March. Whenever the ground is sufficiently dry, the shepherds will begin to burn the heather."

Fattening sheep, whether in the field on turnips or other roots, receiving oil cake or meal at the rate of about one lb. apiece, along with chaff of hay and a daily fold of green food; or in sheltered

yards, brought in for the more economical consumption of their green food there, will now be making their best progress.

Keep them dry, warm, and clean, if in yards, by daily supplies of fresh litter. The wet and cold weather which generally characterizes this month, makes a great difference between fattening sheep *folded* on turnips and sheep fed on them in yards, in cases where the latter can be kept free from foot-rot. Just the same difference, in fact, as the engineer finds in the cases respectively of a colliery steam-engine, with a boiler exposed to rain and snow, and one such as those found in Cornwall, where every part from which heat can escape is sheltered and covered. The farmer's object should be the same as that of the Cornish engineer. Both must adopt every means to economize the fuel; for this is not with them, as with the engine at the coal-pit, *to be had for nothing*. Turnips and oil-cake are both costly articles—as much so to the farmer as are coals in Cornwall; and the object of those who use them must be to produce the intended effect with as small an expenditure as possible. Sheep and oxen in sheltered spots, and well littered, like steam-engines well “jacketed,” waste a less portion of their food or their fuel in keeping up the heat proper to each; and the remaining portion being much larger is more effective, by which the force is maintained in the one case, and the fat is laid on in the other. “Warmth is an equivalent for food;” for, supply warmth artificially, and you will not need to supply so much of the food by which it is maintained naturally. Success in feeding depends, no doubt, on a good selection of stock, and on a proper selection of food for them; but it also greatly depends on the attention of the farmer in keeping his stock dry, clean, and *warm*.

Sheep in sheds should this month be making about their best progress. Those intended for the butcher after shearing in May, should have received from the 1st Nov., peas, oats, or oil cake, commencing with half a pint of the first, three quarters of a pint of the second, or half a lb. of the third; and increasing gradually up to three quarters of a pint, one pint, and one lb. respectively each. They will eat with these from fifteen up to twenty-five lbs. of cut Swedes each daily, according to the weight of the animals. It is a fair rule to go by, that an animal, when full grown, will eat daily of green food a weight equal to one quarter the weight of its carcass when in fair condition; and it may be assumed that the oil cake given will reduce the quantity of Swedes required by about eight lbs. of the latter for every lb. of the former. A good crop of Swedes pulled and cut, the sheep being folded on the land, will keep ten sheep for five months per acre; the same crop may be assumed as equal to the keep of thirteen or fourteen under shed. I have had 350 sheep so kept during winter; they ate about three and a half tons of roots daily; and a lad about nineteen years old, with two

boys under him, managed the whole. They were placed on two sides of a long yard, which was sheltered on each side, and the space under the shed was divided into pens, about ten feet by fifteen; in each of these pens ten sheep were kept. They were littered as often as the straw became wetted, which was about twice a week, and the manure was removed from beneath them about once a month. Their feet were pared once a month; and whenever there appeared the least growth of spongy matter, like that which precedes foot-rot, it was cut, and very dilute nitric acid placed on it. The sheep were fed three times a day, about eight lbs. of Swedes a-piece being given them the first thing in the morning, half a pint of peas about eleven o'clock, four lbs. of Swedes at one p.m., and eight lbs. in the evening.

The practice thus described was faulty, in that the sheep were not littered often enough. It is essential that they be kept dry, in order to avoid the foot-rot; and, if necessary, they should be littered twice a day instead of twice a week.

The subject of feeding sheep in yards has lately (March, 1861) occupied a good deal of attention; and I extract the following from Mr. Ruston's account of his experience, lately read before the London Farmers' Club. His farm lies in the fen district; and mangold wurzels are his great resource for yard feeding either of sheep or cattle. He says—

“These fen lands of ours grow a heavy crop of mangolds and a bulky crop of straw, although the quality is inferior. We have the corn standing in the stackyard, ready to be threshed, that the straw may be converted, during the winter months, into manure: we have the mangolds also carted into heaps in the neighbourhood of the fold-yard, ready to be consumed; and we have the hay stacked there, too, for the same purpose—at least so much of it as is not required for the work-horses. The question then arises, How can this straw be manufactured into manure, and this accumulation of food be consumed most profitably? Can it be best effected by bullocks or by sheep?

“The more common method of converting our coarse straw into manure, and of consuming our mangolds and inferior hay, has been by purchasing for that purpose some growing bullocks in the autumn, giving them a few pounds of cake or corn per day, in addition to the natural food, and selling them again in the spring either at our home fairs, or at Norwich, or in some other grazing district. If the bullocks have kept healthy and thriven well, they have occasionally left 20*s.* or 30*s.* per head for the natural food consumed; but it has been far more frequently the case that they have only just paid for their artificial food, and the mangolds and hay have had to be charged to the manure account. This mode of management was not very satisfactory. But the case has become

even worse during the last few years, since the appearance of the lung disease, and our losses from this cause alone have been fearful.

"I have now tried sheep in yards for five years. Last year the lung disease appearing in a lot of Scots I had, excited my fears lest it should spread and decimate another lot which I had just received from Scotland. I therefore determined at once to send the latter lot away, and sell them again, keeping only those in which the disease had appeared. This drove me to the necessity of purchasing nearly 400 lambs for the purpose of consuming my hay and mangolds, and of manufacturing my straw into manure. I made very close observations, kept a diary of all necessary particulars, valued them into the yards, and valued them out to grass with the dates of going in and out; calculated their cost for artificial food, noticed very narrowly what quantity of straw they made into manure, and also the quality of the manure, as far as appearances enabled me to judge. From close and careful observation last winter and again this—for I have now between 600 and 700 sheep in yards—I find six lambs will tread down as much straw, and make it into good manure, as a 12 $\frac{1}{2}$. or 14 $\frac{1}{2}$. bullock. I put the sheep into my ordinary fold yards, and always calculate six sheep to one bullock; so that where I should have ten bullocks I put sixty sheep. During the whole of last winter I don't suppose I had more than a dozen lame sheep whilst they were in the yards; and there have been far less cases in the yards than there were previously to their coming in. I find it is very essential to keep a thin layer of dry straw over the yard. In wet days we litter them twice a day, and on fine days once, but we only use a small quantity at a time; this just keeps the heat of the manure from rising to injure their feet, and prevents them also treading on wet straw during the day. When they first come into the yard, and indeed until the end of February, when the days begin to lengthen, we give them a larger quantity of dry food; they pick the bedding straw over, and where practicable have a stack or good heap in the yard to run to; we also cut them chaff, hay and straw together, and feed them several times a day with it. We give them a few mangolds twice or thrice a day, but not in quantities sufficiently large to make them scour; but as the days lengthen we increase the quantity of roots, and reduce the supply of dry food. I find an acre of mangolds of an average crop will carry twenty-five sheep—i.e. twenty-five lambs—during the weeks they will require to be in the yard, say from the beginning of December till the beginning or middle of April; old sheep would consume more, and twenty per acre would be a fair calculation.

"I will now present some details in connexion with my last year's experiments. The 377 lambs wintered in the yards last year were bought during the months of August and September, and were kept entirely at grass-keeping without artificial food, until Decem-

ber, when they were consigned to their winter quarters. A few of them were lost during the winter, but at the end of the winter when turned out to grass the following had been the results :—

	£	s.	d.	£	s.	d.
"The whole 377 lambs were valued into						
the yards at	618	14	0			
They cost for artificial food	37	15	1½			
Making a total cost of				656	9	1½
Further, the 364 put to grass were						
valued at	891	12	0			
And the 13 casualties realised . . .	9	16	3			
Making a total of				901	8	3
Which shows a profit on the whole of				244	19	1½
And this I dispose of as follows—						
viz., hay, straw, attendance, at 3s.						
per head, for 377				56	11	0
15 acres mangold, allowing 25 sheep						
to the acre, at 12 <i>l.</i> 11 <i>s.</i> 2½ <i>d.</i> per						
acre				188	8	1½

or, if you take two acres more mangolds, and call the total quantity seventeen acres, it will then give you 11*l.* 1*s.* 8*d.* per acre for them, within a fraction : but I regard the former as the more correct calculation."

This was an instance of extraordinary return, and in Mr. Ruston's case it was contrasted with great ill luck in the cattle feeding with which he had to compare it. This he describes as follows :—

"The lot of Scots to which I have referred as having last year been afflicted with lung disease, were bought on the 12th of March, 1859, and cost just 8*l.* 3*s.* 4*d.* per head when they reached my farm. They were put upon a very good (for our country) field of grass, and made considerable progress, and on the 1st of July of the same year, when taking stock, with a view to closing and balancing my year's accounts, I valued them at 11*l.* per head. On the 29th of October they were put into yards, and I then valued them at 12*l.* 10*s.* per head. But before that time two of them were seized with lung disease, and had to be killed, and by the 3rd of December the number was reduced to eighteen. Some of the best bullocks fell, and I found the better plan was to dispose of them at once, before they sustained any serious harm. After the 3rd of December no more disease appeared, and I kept the eighteen until the 2nd of February, 1860, when they left me in good health, but went to a bad market, keep being very short last spring, and they brought home, clear of expenses, only 12*l.* 11*s.* 6*d.* per head, or just 1*s.* 6*d.* per head more than they were worth on the 29th of the previous October. During the time they were in the yards they consumed chaff—half hay and half straw—and three

pounds of the best decorticated cotton-seed cake each per day. They had no mangolds, as they were at a farm where none were grown that year. The cost per head for cake was 1*l.* 1*s.* 6*d.* The six that fell with lung disease made 29*l.* 6*s.* less than they were valued at when they went into the yards, and the eighteen that did not suffer lost 1*l.* per head on the cake account, besides all the hay, straw, and attendance—rather a costly yard of manure!

“Take, however, a case where 30*s.* per head has been realized for the natural food consumed during the months that cattle have been in the yards, one bullock will return as much profit as two-and-a-half sheep, or a trifle over, and will yet have cost as much keeping as six sheep. The figures will stand thus—Profit on one bullock, 1*l.* 10*s.*; profit on six sheep, which have consumed the same amount of food, and made the same amount of manure, 3*l.* 18*s.* This year, I have, as before stated, 600 sheep in the yards; these are consuming the food and making the manure that 100 bullocks would consume and make. Taking 1*l.* 10*s.* as the profit per head on 100 bullocks, and 3*l.* 18*s.* the profit on six sheep—and I think the latter is quite as likely to be realized this year as the former, and indeed more so—what is my position? Why, instead of getting 150*l.* for the food consumed by 100 bullocks, for the very same food consumed by 600 sheep, I get 390*l.*: which simply puts 240*l.* into my pocket, and emboldens me to argue in favour of sheep as manure manufacturers.”

I give Mr. Ruston's experience in detail as it so strongly justifies his recommendation to adopt the winter feeding of sheep in yards.

On the quality of the manure thus made it seems plain, as manure is just food *minus* growth, that the kind of animal has nothing to do with the question, which hinges entirely on the quality of food and the kind of growth that is being made out of it. Fattening sheep fed equally well make as good manure as fattening beasts. On the other hand, the cattle are more liable to disease, and it seems that fengrown food will not fatten them. Sheep, again, if well littered, will not suffer from lameness, and are not liable to any other attack, and they appear to yield a valuable coat of wool over and above as much meat as is made by bullocks. At any rate, in the case of Mr. Ruston's farm, the difference is amazingly in favour of the sheep, and his experience will no doubt induce many copyists of his example.

SWINE.

Fattening hogs may receive barley meal, and barley and oats, and pease meal mixed in a stiffish paste, as much as they will take daily towards the end of the feeding process. At first, when put up to fatten, large hogs may receive thirty or forty pounds of steamed

roots—mangold wurzels, carrots, or parsnips mixed up in a stiffish paste with four or five pounds of meal daily.

Sows in farrow should bring forth in February or March, and their spring litters of the previous year may be either ready for sale now as stores for fattening, or they may have been fattened during their first winter, and come out weighing ten to twelve scores—more or less, according to the breed—as bacon soon after Christmas.

COMPOSTS AND DUNG HEAPS.

A good deal of work is generally done this month in clearing out yards and building dung heaps in the fields. The instructions given last month may still be observed with advantage. In the earlier edition of this work a quotation * was given commencing thus:—"The farmer may use composts to advantage when they consist of proper materials and are skilfully mixed." The writer goes on to describe the usual practice of making composts as follows:—

"The common way is to lay the several materials in layers, one over the other, till a large heap is raised; and it is the practice of many farmers to make these layers from six inches to a foot in thickness; but this I have found by experience is wrong. For the fermentation raised in the compost is not strong enough to penetrate these thick layers, especially those of clay or strong earth; for after the rest have sufficiently fermented, and the compost is turned, these layers rise almost as whole as when first laid, and must be broken by hand, to mix them with the rest of the compost; whence arise two inconveniences; one, an extraordinary expense of labour; and the other, that twice or thrice turning is sometimes necessary to dissolve these large pieces; and as a new fermentation is excited every time the compost is turned, the strength of the manure is greatly wasted before it is laid upon the land, where it is then incapable of raising any considerable fermentation, which is one of the principal uses of manure.

"The best way, therefore, of making compost, is not in thick layers; but after the ground is marked out for the compost, to lay the several materials, after being well broken, in heaps round the space marked out for the compost heap; and to place a man between each two heaps, to throw the manure abroad upon that space. In this manner the compost-heap will soon be raised to the intended height, and the several sorts of manure being thus well mixed, the whole will soon begin to ferment, and will incorporate as fully in two months, as the same manures, placed in layers in the usual way, will in four or five."

Further remarks are made, but the editor concludes:—

* Arthur Young does not say from whom.

“ So many farmers are fond of composts, that I have ventured this one quotation in their favour, which contains as much as can be said for them. In my own opinion, nearly the whole business of composts is founded in error, and that thus to apply any sort of dung or sea-weed is sure to be done to a loss ; and vegetable substances should be thrown into a yard for making dung.” This is probably the true view of the subject, and the policy of covered yards in which all excrementitious, and vegetable matters as litter, may be mingled and trodden down under cattle, has been already considered. I will, however, add further remarks* on this subject, both on composts and farm-yard manure.

Composts.—The preparation of manure for use during the season of vegetable growth is one great business of the winter season. This includes the purchase of fertilizers (referred to in March), both soluble salts, such as those of ammonia and the nitrates of potash and soda, for application as top dressing to the growing crops later in the season, and the less soluble fertilizers, as guano, superphosphate and bone-dust, which may be applied early in the season with less risk of waste and more probability of being used by the plants as soon as ready for absorption. It also includes the manufacture of heaps of fertilizing matter on the farm, whether of farmyard dung exclusively, or of dung and the various vegetable and mineral auxiliary manures which the farm affords.

1. Of those which are properly the *compost heaps* of the farm :—What a number of things may be turned to good account is plain from the mere list of the animal, vegetable, and mineral substances existing on the farm, of some use as manures. There are thus, roots, hedge-clippings, fallen leaves, weeds, couch-grass, fern-leaves, moss, river- and sea-weeds, sods and turf from ditches, lanes, and hedgerows, sawdust, spent bark and peat when properly decomposed, among vegetable substances. Many of them contain their nitrogenous part in a higher proportion than the straw of grain, and several of them are equally rich in the mineral constituents of plants. Besides these vegetable substances there is the animal waste, sometimes accessible on a farm, such as carcasses, blood, bones, fat, blubber, waste fish, sprats, muscles and other shell-fish, which are in some places and sometimes to be had. They all contain a large proportion of nitrogen, much more, indeed, than ordinary farmyard dung. Mineral substances are also available, such as earth from hedges, scourings of ditches, banks, ponds, road-scrappings, and various marls, chalk, and sometimes beds containing a considerable proportion of phosphate of lime. Refuse substances of trade are also sometimes available, and equal in their fertilizing effects to any known manure ; such are woollen rags, shoddy,

* Carter's Gardener's and Farmer's Vademecum, 237, High Holborn.

soapers' waste, glue refuse, refuse of starch and sugar-works, of provision-curers, slaughter-houses, curriers, &c.

Any of these substances which contain the food of plants are of course applicable with good effect as a manure; but besides their direct contribution of matter to be built up in the growing crop, their influence on the texture of the soil to which they are to be applied has to be considered; and hence, when applying mineral matter we improve light soils by the use of clayey composts, and stiff soils by the use of light and organic composts. It is, however, the advantage of the compost form of manure, that the effect produced by its application is greater than the sum of the effects which would have been produced by the separate use of its several ingredients. And hence, in making our composts we use such ingredients as will improve and act on one another in the heap. Many of the ingredients named require a complete disintegration, in order to their fertilizing character, and hence lime, which facilitates their decomposition, is a very important ingredient in most composts. Peat, for instance, is a substance which can be brought into use by the aid of lime, and composts of peat thus prepared, with the addition of farm dung, are often a most successful method of eking out and increasing the fertilizing resources of the farm. In practice, a half-charred mass of rough vegetable matter if it have been originally woody, or a half-rotten heap of such matter, if it have been originally succulent, along with lime, or even mere mould, may well be made the foundation and the top layer of heaps containing rotten flesh or blubber, or mere dung, to be ultimately well mixed up together and used, as the dung heap usually is, for the green crops of the farm. If the land be light or spongy it is well to mix as large a proportion of clay or marly earth as possible, for the sake of its influence on the texture of the land.

It must, however, be added, that it is not to be recommended that much time be devoted to compost-making on the farm. Such manures are bulky, and involve great labour of cartage, and the system now is to spend money rather on the direct purchase of cattle food or portable manure, than on the labour of developing the less immediate home resources of the farm. The use of many of these ingredients, as peat, first well dried and broken, sawdust, and even spent bark (which is best half charred before use), is best confined to their employment as litter or in the yards, where they may suck up liquid fertilizers, otherwise liable to waste. If laid up in heaps they should be soaked with gas-water liquid manure, or other easily fermentable substances by which they are reduced into a more soluble condition. If lime be mixed with them, its caustic effect will be increased by the addition of a certain proportion of common salt.

2. Of *Farmyard dung* :—This, as it consists specially of what

has already grown out of the soil, acts as a fertilizer by restoring to the land ingredients taken thence, together with matters drawn also from the air, which shall thus feed another crop of plants. It is well, in order to check waste of manure on the farm, to have a distinct impression of the quantitative nature of the fertility of the soil. Given a suitable climate and suitable plants, it depends entirely on the presence in sufficient quantity of those particular atoms which the plants invigorated by that climate need for the erection of their structures. It is often declared that the rain washes the valuable *quality* out of the dung, and that exposure to air induces the loss of its valuable *qualities*. Now, the quality of a manure depends altogether on that of its constituent particles. It is because ammonia contains nitrogen in a form in which plants can use it, that it is a useful element of the dung-heap, and to speak of exposure as rendering dung liable to the loss of much of its valuable qualities, just means that it is liable to the loss of its ammonia. So with the phosphates and other soluble salts. Dung never loses quality except by losing quantity. They are actual material particles, possessing weight, which fly from it or which flow from it; and the distinct and definite idea that so much matter has gone by mismanagement, which if built into the plants would have added to their weight, is one which it is well to have fixed in the mind. The loss of so-called quality might be borne under the idea that by skilful management its lost character might be restored: the loss of so much quantity is absolute and irreparable; as entire as if the value of the quantity in question had been thrown into the sea.

The waste to which farmyard dung is liable arises chiefly out of the mode of its manufacture. For the sake of obtaining the dung in a condition in which it contains ready-made the food of plants, and in which it may be easily mixed with the soil, it is fermented in large heaps, and these are generally open to the air and rain. The consequence is, that the products of the fermentation which ensues escape into the air or are washed out into the ditch, and in either case are lost to the farmer. The remedy is either to plough the manure under as soon as made, *i.e.* as soon as the litter is used and soiled, or to gather it in heaps from day to day as made, placing it on a layer of absorbent earth, and covering it with a layer of earth in a ridge-form, as described in January, which shall shed the rain and suck up all exhalations. Dr. Voelcker tells us indeed that it is much more by the washing of rain-water than by the escape of the gaseous products of fermentation that manure suffers loss, and that no better plan exists of applying dung to the land than spreading it over the surface as soon as made, whether it be ploughed under at once or not. When freshly made it contains but little matter capable of loss by exposure, or by washing, but

this loss becomes possible and actual as it rots in heaps together. The inference as to top-dressing of recent manure during the winter months, to be ploughed under as the weather permits, before spring time, is one which ought to be fully tested in the field.

The use of an absorbent and disinfectant substance which shall fix the volatile products of fermentation and at the same time hinder the fouling of the air of our stables and feeding-houses, would be almost done away with, if the practice should prevail of ploughing in or applying dung as soon as made; nevertheless for a long time to come, indeed always as regards a considerable portion of the manure of the farm, dung will be rotted in heaps, and the means of retaining and fixing the products of its fermentation will be used. Earth covering the heap is an efficient strong box for the vapour of a rotting dung-heap. Charcoal, which has been highly spoken of for this use, is a good disinfectant; but this is by oxidizing, which means burning up the emanations which we wish to retain. To cover the dung-heap with charcoal would indeed remove all smell, but this it would do by destroying or converting into substances unavailable for plants the things we wish to use. Gypsum is good as a manure in itself, but comparatively inefficient as a fixer of ammonia, owing to its comparative insolubility. Chloride of zinc (Sir W. Burnett's disinfectant) is costly and poisonous. Sulphate of iron would be a good fixer of ammonia, owing to the sulphuric acid it supplies, but its iron would convert the phosphates into an insoluble and useless salt. Common salt has some powers as a fixer of ammonia, but these depend upon affinities so nearly balanced as to render them neither permanent nor long-lived. Sulphuric acid would indeed be a good fixer of ammonia, but it is entirely unfitted, by its corrosive properties, for use near animals. Mr. M'Dougall, of Manchester, suggests the alkaline or lime salts of carbolic acid, a product of the distillation of coal, as an efficient and harmless fixer of ammonia, and disinfectant, and there exist testimonials in its favour in the latter respect.

The quantity of farm manure possible on a farm.—The following data may assist an estimate. On Whitfield farm, Gloucestershire (150 acres of grain crop, 30 acres of clover, and 60 acres of green crop), upwards of 2000 cubic yards of manure were made annually, or probably about 1200 or 1300 tons, and this would represent one ton of straw as making about four tons of dung. This was when large quantities of green crops were grown, probably 1000 to 1200 tons of roots each year. Again, as so many separate facts bearing on this question, it may be added (*a*) that an ox fed on green food and hay and straw will yield about one cwt. of excrement, liquid and solid, daily. Mr. Haxton, in the 'Cyclopædia of

Agriculture," calculates that a stall-fed ox of full size will yield of solid dung during—

	tons	cwt.	qrs.	lbs.
210 days 55 lbs a day	5	3	0	14
155 days 41 lbs. a day	2	16	0	27
Add litter 14 lbs. a day	2	5	2	14
Urine absorbed by litter 22½ lbs.	3	13	1	8
In all, per annum	13	18	1	7

But besides this a lot of urine runs to waste, making altogether probably about twenty tons per ox, stall-fed, throughout the year. If the ox be box-fed rather more litter is needed, and all the urine is absorbed by it, so that the quantity is not only greater, but its quality is better. On this point Professor Way's figures* may be quoted. He found box manure to contain 71 per cent. of water, and nitrogen equal to 2·37 per cent. of ammonia, when yard manure, otherwise similarly made, contained nitrogen equal to only 1·7 per cent. of ammonia. Box manure contained also ·3 per cent., or one half more, of phosphoric acid, and 2 per cent. of potash and soda, or more than twice as much as in farmyard dung.

b. The horse voids about 35 to 40 lbs. of dung daily. It loses more by perspiration, and is generally fed on drier food than the ox, so that there is less urine and the dung is drier. Mr. Haxton calculates its annual yield at about 11 tons:—Much however of it is wasted on the roads when it is out at work. (*c*) Of pigs and sheep it may be estimated that eight or ten make as much manure as a full-grown ox, consuming as they do about the same quantity of food. (*d*) If 600 acres be cultivated on a six-field system, it may be supposed to yield per annum 600 tons of dry fodder and litter, and 2500 tons of green and succulent food; and the produce of manure may be estimated thus:—The winter food will keep 120 beasts or 1000 sheep, yielding 1600 tons of farm dung during the winter months. The summer stall feeding and the stable may be expected to yield other 400 tons, or 2000 tons in all. How much this may be reduced in quantity and how much in quality by mismanagement, Dr. Voelcker has shown in his illustrations of the superiority of winter top dressings, and of the application of fresh-made manure, or of box-feeding and manure-making under cover, over the ordinary method of treading straw down in yards, and "making" the dung in exposed and rapidly fermenting heaps."

X.—FENCES.

February is a good month for planting young quicks for hedges. The line of the fence should have been deeply trenched the previous

* See Mr. Lawrence's paper, Eng. Ag. Soc. Journ. vol. xviii.

autumn ; and if the ground be drained all that is now needed is to lay the young plants in a straight trench cut in this tilled soil, about five or six inches apart, having previously cut off the head at about two or three inches above the surface of the ground, and also pruned any extravagance or irregularity of growth in the roots. A row of railing on each side of the young fence is needed for its protection ; and this in some districts would be a costly affair. It is common, therefore, to dig a ditch along one side of the intended fence, and throw the earth beyond, upon its other side ; there is thus a ditch on one side and a mound on the other for its protection. When materials for posts and rails are abundant, the natural position of the young plants in well and deeply tilled soil, undisturbed by a ditch or mound, is the best. A double row is recommended as preferable to a single one for an efficient fence ; the rows should be about ten inches apart, and the plants in each eight inches apart, placed opposite the intervals, in the other.

Old Enclosures.—In various parts of the kingdom, farms that have been enclosed, perhaps for ages, are split into such a number of small fields, that the loss of land by hedges, ditches, and borders, is ruinous, and the evil so great, that a spirited tenant must determine as soon as possible to throw several of such small fields into one, leaving the enclosures of such a size as suits the extent of the business, and of such a form as admits the operations of tillage without loss of time by the team perpetually turning. This is a business of considerable importance, and a judicious landlord should second the views of his tenant by removing the trees which stand in such condemned hedge-rows.

Woods.—This month, as well as the preceding, is a good season for felling underwood, in which work, and the converting of the product to the best profit, lies much judgment. In some counties hoop stuff pays best ; in some, hop poles are, of all other articles, the most profitable ; in others, faggot-wood of various sorts. In some situations copse-wood, loose or tied in faggots, is particularly valuable. In others, nothing in a wood pays so well as hurdles. Whatever answers best, the farmer should apply his wood to, and subject his management of it to such changes as a variation in demand may occasion.

Plant Osiers.—It is now a proper time to plant osiers. Such plantations pay well in low, spongy, boggy bottoms near a stream. The land should be formed by spade-work into beds, six, eight, or ten feet broad, by narrow ditches ; and if there is a power of keeping water in these cuts at pleasure by a sluice, it is in some seasons very advantageous to do so. February is also a month for cutting osiers. (See January.)

Hop-grounds continue to give work in February as during January, in draining, grubbing, and trenching ; in cutting underwoods, &c.,

and ditching and planting in the coppices ; in throwing and sorting hop-poles, and in digging some of the free-working hop-grounds. On wet days some of the men may be employed in mixing up manures in preparation for application. This latter process is managed under cover, thus—with 600 bushels of ground bones may be mixed three times as many bushels of dry ashes ; and to this compost is added strong urine water from the tank, which is pumped into the mixture as required, until each portion is thoroughly saturated ; it absorbs about half the measure of water. It is then successively cast up into a large heap, interspersed with layers of gypsum, and the top covered over with common salt. It will soon become intensely hot in the interior ; and, of course, the bones will quickly decompose. It constitutes an excellent manure for turnips or for any kind of crop, hops among the number. The teams will be engaged during rough and frosty weather in carting hop-poles, dung, stones, wood, &c., and in fair weather in ploughing after turnips for the spring crops.

Irrigation proceeds in February as in January until towards the end of the month, when the land is laid dry, and affords the earliest spring food that can anyhow be obtained.

Grass lands for mowing or for grazing in the ensuing summer are as nearly as possible at rest. The ewe flock may be kept on the drier pastures still ; and the application of artificial dressing to the land, referred to in the month of March, may be commenced ; but all stock should now or very soon be sent out of the fields, which must next month be picked, bush-harrowed, and rolled, and shut up for some weeks before the spring growth commences.

MARCH.

The ordinary weather of March may be gathered from the figures of the meteorological table on the next page, which describe the temperature and rain-fall during this month at a number of English stations. March is one of the stormiest months of the year, but almost as variable in its character from year to year as February. Sometimes wet, late, and tedious ; and at others early, dusty, and active.

The ordinary operations of the farm during March direct the attention of the farmer especially to the subject of (1) *seeds*, and (2) *artificial manure* ; both of which he must purchase for use upon the farm. Sowing operations include the continuance of (3) *barley sowing*, the completion of (4) *spring wheat*, and also, if pos-

THE WEATHER OF MARCH.

LOCALITY.	AUTHORITY.	Mean tempe- rature.	Lowest mean tempe- rature.	Highest mean tempe- rature.	Greatest heat.	Lowest maxi- mum heat.	Highest mini- mum cold.	Greatest cold.	Average amount of rain. inches.	Smallest amount of rain. inches.	Greatest amount of rain. inches.	Average number of rainy days.	Smallest number of rainy days.	Greatest number of rainy days.	No. of years obser- vations.
Guernsey	Dr. Hoskins, F.R.S.	48.2	39.7	46.4	61.5	51.0	37.5	29.5	1.8	0.4	5.9	12	4	22	13
Helston	Mr. M. P. Moyle ...	46.3	41.4	49.7	67.0	56.0	34.0	18.0	2.9	1.1	6.3	13	4	23	17
Exeter	Mr. W. H. Ellis.....	43.7	41.6	46.7	68.7	56.7	30.7	21.0	2.7	0.3	4.7	18	4	28	13
Ventnor, I. of Wight	Dr. Martin	44.4	39.4	47.7	65.0	53.0	35.0	20.0	1.7	0.1	4.1	12	2	21	22
Worthing, Sussex	Dr. Barker	41.0	37.7	45.9	69.6	47.7	32.8	25.0	1.2	0.1	1.8	10	3	20	8
Clifton near Bristol	Mr. W. Burder, FRAS	41.4	37.9	45.5	66.3	53.9	27.1	20.9	1.9	0.5	4.7	14	5	21	8
London Royal {	{ The Astronomer {	40.9	33.9	49.2	71.5	49.0	35.0	13.1	1.4	0.2	4.1	10	3	21	13
Observatory	Royal, F.R.S.	41.4	—	—	66.6	45.8	36.0	13.0	1.4	0.1	3.2	—	—	—	31
Oxford Observatory	Rev. R. Main, F.R.S.	41.7	37.1	47.4	70.0	55.0	29.2	20.0	1.1	0.4	2.8	11	2	21	10
Bedford	Dr. Barker	41.0	38.3	44.4	71.0	54.4	24.2	12.8	3.6	1.0	5.3	17	3	25	6
Lampeter, near {	Rev. Prof. Matthews, {	40.2	34.0	46.7	66.0	54.0	31.0	12.0	1.4	0.1	3.2	12	5	25	20
Cardigan	M.A.	42.1	35.6	46.6	71.5	52.9	31.0	13.0	1.4	0.3	3.9	14	5	24	14*
Norwich	Mr. W. Brooke, FRAS	40.6	36.9	45.7	67.7	51.5	30.0	21.1	1.5	0.3	3.3	14	5	23	10
Highfield-House {	{ F.R.A.S.	41.1	38.1	45.2	67.5	52.0	30.0	17.5	1.8	0.7	3.4	9	2	19	11
Observatory.. {	Mr. J. Jeans, F.R.A.S.	41.3	38.2	44.8	74.0	53.5	27.0	15.0	1.9	0.2	3.5	16	5	22	12
Grantham	Dr. Moffat, F.R.A.S.	42.2	39.0	46.0	73.0	56.0	30.0	21.0	1.5	0.3	3.4	13	4	24	11
Hawarden, Chester	Mr. G. Vernon, FRAS	40.2	35.9	45.9	67.0	49.0	30.0	14.0	1.4	0.3	3.3	11	3	23	20
Manchester	Mr. H. Denny	39.9	35.8	45.0	66.0	45.0	31.0	20.0	1.1	0.7	1.5	8	3	13	6
Leeds	Mr. Ford	38.0	34.0	44.2	61.1	51.3	32.0	25.6	2.1	0.8	3.0	13	3	22	7
York	Mr. B. Cooke	37.4	33.7	44.0	62.5	53.1	28.7	16.3	1.2	0.3	2.3	10	5	18	5
Scarborough	Mr. J. Burman, FRAS	40.3	35.7	45.4	64.0	49.2	30.2	15.6	1.7	0.1	3.3	18	11	25	17
Isle of Man	Mr. A. Marth, FRAS	41.2	37.0	44.7	61.5	53.4	30.8	17.1	2.7	0.1	5.1	14	2	24	7
Durham Observtry	Mr. R. Spencer														
North Shields	Rev. F. Redford														
Silloth															

* Observations at Highfield House on temperature extend over fifty years, and at the Royal Observatory over ninety years.

sible, of (5) *oats*, and the getting in of (6) *clover and grass seeds*; also of (7) *sainfoin*, and (8) *vetches*; and the planting of (9) *potatoes*. The preparation of land for carrots and mangold wurzels will also occupy attention; and (10) various *hoeing operations* will be commenced.

Among other more occasional work may be named (11) *paring and burning* grass lands to be broken up, which should be done as early as possible in the year. And (12) the *live stock of the farm*, including (13) the *management of the dairy*, takes as much of the time and attention of the farmer as at any season of the year. Towards the end of the month, the subjects of (14) *farm accounts* and (15) *Lady-day entries* also force themselves upon him.

I.—SEEDS AND SOWING.

It is of importance that we sow (*a*) only those seeds which we want to grow; that (*b*) they be alive when we sow them; that (*c*) they be placed just thick enough upon the ground, and (*d*) just deep enough under the surface. Each of these points deserves separate notice.

(*a*) **Purity of Seed.**—On this subject Professor Buckman, of Cirencester, has drawn attention to the immense quantity of weeds which the crop seeds bought in the market usually contain. The following are some of his remarks. The Table specifies a number of the results obtained by him during a laborious examination of samples purchased in the market.

TABLE OF WEED AND OTHER SEEDS MIXED WITH CROP SEEDS.

Crop.	No. of Weeds in a pint.	Remarks on principal contents, &c.
1 Alsike clover	7,600	Grasses, Umbelliferæ, and Polygonacæ.
2 Cow-grass clover	12,000	Umbelliferæ, Polygonacæ, Creeping Crow-foot, Sherardia.
3 " " " " " " " " " "	6,400	Plantain and Umbelliferæ.
4 Broad clover " " " " " " " " " "	7,840	Much as 2.
5 " " " " " " " " " "	1,040	
6 " " " " " " " " " "	8,400	Umbelliferous plant.
7 " " " " " " " " " "	39,440	Plantain and little weeds.
8 White Dutch clover	26,560	Sandworts, Ranunculus, Polygonacæ.
9 " " " " " " " " " "	70,400	Plantain, Polygonacæ, and Caryophyllacæ.
10 Trefoil	1,920	
11 Lucerne	880	
12 Vetches	32	
13 Beans without cleaning, but as planted	5,000	Black Mustard, Charlock, Polygonacæ, Convolvulus, &c.
14 Peas as planted	1,550	Charlock, Campion, Bindweed, &c.
15 Perennial rye-grass (English) ...	3,840	{ <i>Holcus mollis</i> = 1,680 <i>Bromus mollis</i> , or <i>Lop</i> = 800 <i>Ranunculus repens</i> = 480 Undetermined = 880
16 Vetches	10	
17 Canary grass	520	
18 Perennial rye-grass	800	
19 " " " " " " " " " "	3,200	½th <i>Lop</i> , <i>Holcus lanatus</i> , &c.
20 " " " " (Pacey's)	1,120	<i>Lop</i> , &c.
21 Italian rye	3,200	Field Madder, Sandworts, &c.

Crop.	No. of Weeds in a pint.	Remarks on principal contents, &c.
22 Italian rye-grass imported, A. ...	7,040	Lop, soft grass, and creeping crowfoot.
23 „ „ „ B. ...	1,600	Lop, soft grass, &c.
24 „ „ „ Hop, ...	4,880	Lop, Sherardia, Ranunculus, Plantain, &c.
25 Hop and red clover, mixed ...	7,200	Ranunculus, Plantain, Chickweed, Sandworts, &c.
26 Yellow oat-like grass, <i>Av. flavesc.</i> ...	560	Mostly a species of rush.
27 Meadow fox-tail, <i>Alopecurus pra.</i> ...	1,320	<i>Alopecurus agrestis</i> , Lop, &c.
28 Cock's-foot, <i>Dactylis glomerata</i> ...	9,200	<i>Holcus lanatus</i> and <i>Arrhenatherum</i> , nearly half weeds.
29 Hard fescue, <i>Festuca duriuscula</i> ...	4,600	Lop, <i>Holcus</i> , &c.
30 Oat-like grass, <i>Arrhen. avenaceum</i> ...	800	Mostly Lop.
31 Mixed grasses ...	8,400	Ranunculus, <i>Holcus</i> , &c.
32 <i>Festuca ovina</i> ...	2,620	Medick.
33 Mixed grasses ...	3,640	Plantain.
34 Linseed ...	4,600	Polygonaceæ, Charlock, Scabiosa, & grasses.
35 „ as a sample ...	15,520	Black Mustard, Charlock, a cress, &c.
36 Mangel-wurzel ...	320	Mostly Polygonum, Convolvulus.

A study of this table, knowing the extraordinary fecundity of some plants (a single individual groundsel yielding often upwards of 6000 seeds) will give a due impression of the injury done by impure seed.

It is worth knowing, too, that in sowing sixteen pints of clover seed per acre, you *may* be spreading 100 seeds of weeds on every square yard of the land on which you are thus wanting to grow clover alone.

The following, accordingly, in further illustration of the weeds in grass and clover, is a list, taken from the *Agricultural Gazette*, of plants contained in a square yard of "old seeds," in a field near Cirencester, taken in August, 1859.

	Botanical Name.	Common Name.	No.
1	<i>Plantago lanceolata</i>	Narrow-leaved Plantain	7
2	<i>Ranunculus repens</i>	Creeping Crowfoot.....	8
3	<i>Centaurea scabiosa</i>	Hardhead	2
4	<i>Leontodon Taraxacum</i>	Dandelion	2
5	<i>Apargia autumnalis</i>	Autumnal Hawbkit	1
6	<i>Glechoma hederacea</i>	Ground Ivy	6
7	<i>Prunella vulgaris</i>	Self Heal.....	4
8	<i>Convolvulus arvensis</i>	Small Bindweed.....	1
9	<i>Æthusa cynapium</i>	Fool's Parsley	1
10	<i>Cerastium arvense</i>	Mouse Ear	2
11	<i>Sherardia arvensis</i>	Field Madder.....	6
12	<i>Triticum repens</i>	Common Couch	2
13	<i>Agrostis stolonifera</i>	Creeping Bent	4
Total of Weeds.....			46

In describing them, Professor Buckman says, "the clover and rye grasses had nearly died out—a result which is soon secured in 'seeds' by too great tardiness in commencing to make seed hay on the one hand, and the increase of weeds by seeding on the other." He further gives the botanical contents of three fields of clover,

showing that though within a bow-shot of each other, and all situate on the stonebrash of the great oolite, yet they nevertheless differ immensely in the weeds which the same crop and farming may present. Of a list of sixty-four species observed in the three fields, only twenty-four species, or a little more than one-third, were common to all; and yet the aboriginal flora of any three fields of the district would scarcely offer half a dozen species in one field that could not be found in all. The difference in these fields was simply the result of obtaining the seeds from different seedsmen, which are grown in different localities. This is clearly illustrated by the Lop grass: the true *Bromus mollis* is found in one field out of the three; the Smooth Lop, *Bromus racemosus* in another; whilst the third has neither. The fact is, *the farmer sows most of his weed pests*. They come with his seeds of various kinds; and, in the case of the clover crop, (1) each weed seed sown subtracts from the sum of the clover seed; but this is not all, as (2) very many of the weeds grow so fast as to smother and kill—or at least so much weaken that winter kills—many of the clovers in their neighbourhood; and (3) many weeds seed the first year, and are succeeded in the next by an immense increase—three circumstances which, in a great measure, would account for much of the so-called clover sickness of the soil.

This is the case of clover seed: look now to the risks run by those who buy turnip seed, and others of that class. They suffer from the direct mixing of charlock seed, bought as refuse for 2s. 6d. the bushel, with turnip seed sold for 9d. the lb. And not only home-grown but foreign rubbish has been used for these nefarious purposes; Indian rape, and other similar seeds, first killed, are offered in large quantities to the trade for mixing with turnip seed.

Flax, again, as illustrated on the previous page, is also liable to useless admixtures—the result in this case rather of carelessness than fraud. Professor Buckman, of the Royal Agricultural College, Cirencester, to whom we owe almost all our knowledge of this subject, describes a case in which two oz. of flax seed having been examined by him, showed that with every pint of the seed between 4000 and 5000 seeds of weeds are sown. These weeds included several mustards, corn cockle, grasses, and millet. “The flax-grower,” he says, “prefers such an example because he can purchase it cheaper, but it would hardly be sold to him for half the price of a pure seed; and yet, putting out of sight the evil of sowing weeds, he ought to have it at half price, for of the whole weight nearly one-half was made up of weeds and dirt.” It is plain, then, that the agriculturist should insist upon obtaining pure and genuine seed, and that he should not seek cheap bargains in the seed market.

(b). **Vitality of Seeds.**—This is not equally strong in seeds just ripened; and the difference increases with their age. On this subject we repeat the following, lately published elsewhere.*

* The Oxford Journal, Jan. 1861.

Plants vary exceedingly in their original vitality owing to the circumstances of their growth. We are just within the northern edge of the district proper to one—in the very midst of the country proper to another—and it may be on the southern edge of the latitudes proper to a third—and it will thus easily be understood how an extraordinary severity of weather should kill one plant while another remained unaffected, and a third might even be improved. There is many an illustration of this kind to be found among the crops of 1860.

We are near the northern edge of the wheat country, as well as of the mangold wurzel. Both of these crops accordingly have suffered, and of neither has there been generally a full and satisfactory ripening of the seed. We are nearer the southern limit of the latitudes proper to many of the Brassica tribe of plants, and our turnips, swedes, and kohl rabi have been unusually prosperous.

Many of our garden as well as field plants have barely ripened their seeds. Lettuce, onions, carrots, parsnips, have yielded very little ripe seed. Many of the small seed growers of Essex, we understand, are ruined, while the large houses in the seed trade, holding, as they do, large stores of surplus stock, will make their fortunes. This latter announcement is no better news to us than the former; it means that the seed to be offered during the current spring will be made up partly of the badly ripened growth of 1860, and largely of the older seeds of former years. Now, few seeds are long-lived, though great difference exists among them in this respect. In the first place, their longevity depends a good deal, no doubt, on the degree of their original vitality; and we shall be worse off in 1862 if we have then to depend on the surplus stock of 1860, than we are in 1861 having to depend on the surplus growth of 1859. But, supposing them originally of equal quality, there is still great variety in plants as to the length of time during which their seeds retain their life. Almost the only exact information we possess on this subject is derived from reports of Committees of the British Association. In that of 1850 accounts are given of 300 species experimented on during ten years, from which it appears that two-year-old seed is generally much inferior to new seed, and that a third and fourth year kills nearly all. Seeds two years old are dead to at least twenty-five per cent. of their number; three-year-old seed is half of it dead; of the four-year-old seed only fifteen per cent. are alive; and above four-year-old not five per cent. of seeds are living. Very few indeed ever survive their tenth year. This, however, expresses only the general truth, for seeds differ exceedingly in the tenacity with which they retain life; and the following are the results derived from some of the experiments reported on

to the British Association. Of 100 seeds of each plant, the following number germinated at the different ages named:—

Names.	Per-centage of life at					
	3	4	5	6	8	9
	years old.					
Barley	28	—	—	—	1	0
Carraway	1	0	0	0	0	0
Parsnip	7	—	—	—	0	0
Carrot	16	—	—	—	1	0
Rape	72	—	—	—	1	0
Turnip	37	—	—	—	2½	1
Cabbage	8	—	—	—	0	0
Maize	42	—	—	—	—	—
Canary	49	—	—	—	9	—
Oat	79	—	—	—	18	0
Wheat	54	—	—	—	0	—

These figures indicate a part only, however, of the mischief suffered by using old seed, both because the small per-centage which actually survives and germinates produces weak and sickly plants, and because while the small per-centage named may be entirely trustworthy under careful management, when all the conditions of good tilth, moisture, and warmth are observed, it is by no means certain that they will be available even for the production of those weakly plants under the ordinary circumstances of farm management.

It is plain, then, that the farmer must, in buying seeds, take pains to be sure that they are young and living. The energy of vitality which they may possess should be ascertained by sowing in a flower-pot a sample of 100 seeds taken from the bulk which is offered to him.

(c) **Thickness of Sowing.**—It is a mere problem in arithmetic by which we learn the preposterous number of seeds we usually plant on every square yard of ground by an ordinary seeding. There are 15,000 grains in every pound of barley, and if three bushels are sown on every acre, there will thus be placed 500 grains on every three feet square. There are 180,000 to 200,000 seeds in every pound of turnip seed; and if three pounds be sown per acre in rows two feet apart, each row will have in every yard of it nearly 100 seeds struggling for existence. Of course, arithmetic is not agriculture, and whatever the former may declare, the practice of the latter must depend on the teachings of experience in the field. If it be really found, however strange it may appear, that the best crop of barley, for instance, is to be had by so thick a seeding as has just been named, of course it will be proper to continue it; but I believe that the circumstances of the soil, and the practice of soil cultivation, have so greatly and so generally improved of late years,

that this is one of those cases in which the improvement of plant cultivation has not kept pace with it, and that there is scope for a safe and advantageous diminution in the quantity of seed we use per acre arising out of the diminished risk attending seed since land-drainage and more thorough tillage have been general.

It is in the diminished need of excessive seeding that we are to find some consolation during years (like 1861) of probable inferiority of seed; and, though seeds of a doubtful vitality be not the best adapted for experiments in thin seeding, yet, if a preliminary experiment be made, in order to ascertain the per-centage of the seed we have to use which is alive, we may then proceed with confidence. Though half the seed be dead, it is nevertheless some consolation to know that in five pounds of white clover and ten pounds of red clover, no uncommon quantity to sow per acre, there will yet remain 500 living seeds to lie on every three feet square of ground. So many plants, of course, will never "come;" but why "of course"? Because, besides the dead and worthless seed, which cannot sprout, there is in every sample sown so large a per-centage never covered, and so large a per-centage buried.

It is first in the preparation of a seed bed, and then in the proper placing of the seed just under its surface, that ample room exists, as we believe, for such a diminished use of seed as will more than meet the diminished supplies which our seed growers this year (1861) have in store. How large a margin there exists for economizing here, wherever proper means are taken to place the seeds we sow in circumstances favourable to their germination, will appear from the following list of agricultural seeds, the number of them in a pound, and the number usually sown per acre:—

Plants.				No. of Seeds per lb.	No. of Seeds sown per Acre.
Wheat	...	...	..	10,000	1,000,000
Oats	...	...	...	18,000	3,000,000
Barley	...	...	...	15,000	2,500,000
Rye	...	...	...	20,000	3,500,000
Beans	...	...	...	1,000	140,000
Peas	...	...	...	2,000	300,000
Turnip	...	...	...	180,000	500,000
Mangold Wurzel	...	...	...	*20,000	140,000
Carrots	...	...	...	200,000	1,400,000
Parsnips	...	...	...	100,000	700,000
Rape	...	...	...	120,000	1,200,000
Vetches	...	...	...	8,000	1,800,000
Sainfoin	...	...	...	20,000	2,000,000
Lucerne	...	...	...	200,000	3,000,000
Flax	...	...	...	100,000	15,000,000
Red Clover	...	...	...	250,000	2,500,000
White Clover	...	...	...	500,000	2,500,000

* Each mangold seed is a capsule containing two or three seeds.

Grass seeds vary in number from 500,000 to two or three millions per pound, and in weight from four or five pounds in the case of Meadow Foxtail, to as much as forty pounds in the case of Timothy grass, per bushel—from two to ten pounds being sown per acre in mixtures with other grasses.

(*d*) **Depth of Sowing.**—Suppose a seed to be alive, and suppose that the seed-bed has been by cultivation properly prepared, and suppose that a proper quantity per acre is ready to be properly distributed upon its surface, there yet remains the question of depth beneath that surface at which it should be placed.

No covering at all is absolutely necessary. Moisture, air, and warmth enough being present, and light being absent, germination will proceed, whether any other thing be in contact with the seed or not. Light has a deoxidating influence on vegetation; inducing, for instance, the decomposition of carbonic acid gas where it exists in the juices under the green surfaces of plants, fixing its carbon in those juices, and causing the separation of its oxygen, which escapes into the air again; and as the process of germination, and the conversion of starch into sugar, which is part of it, involves the opposite process of absorbing oxygen and evolving carbonic acid, no doubt it proceeds better in the dark than in the light. There is, therefore, some use of a covering for the seed; but, apart from this consideration, if moisture, air, and warmth be present, no matter how that be insured, a living seed exposed to them will send forth its plumule and its radicle and become a living plant.

In practice, as we all know, these conditions are insured by a covering of earth; the warmth is given by the weather, but the earth insures the moisture and it excludes the light, and it does not exclude the air. In order to all this, it needs to be fine enough—that is, made up of particles of a size smaller than the seed it covers, so that the moistened particles may touch the seed in many different points, and so that there may be no hindrance to the swelling of the seed and the sprouting of its germ. It needs, too, to be deep enough, in order that external drought may not deprive it of the moisture which the seed requires. It must not be too deep, or its water and itself together may exclude the air, which is also needed by the seed, and it may besides so cling together as to form a prison, from which the sprout cannot escape. What, then, is the depth which will insure the best possible combination of all these circumstances? It will certainly vary in the case of different seeds, for they vary in size, in the density of their husk, and in their sensitiveness to moisture; it will probably vary for any one seed in the case of differing soils, for a given depth of one would be equal in its power of retaining moisture, and excluding air and light, to a very different depth of another of different consistency

or character. What it is in any particular case can be ascertained by experience alone.

The following are the conclusions arrived at many years ago by the late Mr. Sterling, of Glenbervie, in the county of Stirling, from a series of experiments of the kind instituted by him, and published in the *Transactions of the Highland Society* at the time. I believe that they are unique of their kind; or, at least, that the results of no similar experiments have ever since been published.

The table is extracted from the "Cyclopædia of Agriculture." The series related almost exclusively to the grasses, and in the following table, Column I. contains the name of each grass; Column II. the depth at which the largest number of its seeds vegetated; Column III. the depth at which about one half came up; and Column IV. the depth from which none whatever appeared:—

I.	II.	III.	IV.
	Inches.	Inches.	Inches.
<i>Agrostis stolonifera</i>	0 to $\frac{1}{2}$	$\frac{1}{2}$ to $\frac{3}{4}$	1
<i>Aira cæspitosa</i>	0 — $\frac{1}{8}$	$\frac{1}{4}$ — 1	$2\frac{1}{4}$
<i>Alopecurus pratensis</i>	0 — $\frac{1}{8}$	1 — $1\frac{1}{4}$	$2\frac{1}{4}$
<i>Anthoxanthum odoratum</i>	0 — $\frac{1}{2}$	1 — $1\frac{1}{4}$	2
<i>Arrhenatherum avenaceum</i> .	$\frac{1}{2}$ — $\frac{3}{4}$	$1\frac{1}{2}$ — $1\frac{3}{4}$	4
<i>Dactylis glomerata</i>	0 — $\frac{1}{4}$	$\frac{3}{4}$ — 1	$2\frac{1}{4}$
<i>Festuca duriuscula</i>	0 — $\frac{1}{4}$	1 — $1\frac{1}{4}$	$2\frac{1}{4}$
— <i>elatior</i>	0 — $\frac{1}{4}$	$1\frac{1}{2}$ — $1\frac{1}{2}$	$2\frac{1}{4}$
— <i>heterophylla</i>	0 — $\frac{1}{4}$	1 — $1\frac{1}{4}$	$2\frac{1}{4}$
— <i>ovina</i>	0 — $\frac{1}{4}$	$\frac{3}{4}$ — 1	2
— <i>pratensis</i>	0 — $\frac{1}{2}$	$\frac{3}{4}$ — 1	$2\frac{1}{4}$
<i>Lolium Italicum</i>	0 — $\frac{1}{4}$	1 — $1\frac{1}{4}$	$3\frac{1}{4}$
— <i>perenne</i>	$\frac{1}{4}$ — $\frac{1}{2}$	$1\frac{1}{2}$ — $1\frac{3}{4}$	$3\frac{1}{4}$
<i>Phleum pratense</i>	0 — $\frac{1}{4}$	$\frac{1}{4}$ — 1	2
<i>Poa nemoralis</i>	0 — $\frac{1}{4}$	$\frac{1}{2}$ — $\frac{1}{4}$	1
— <i>trivialis</i>	0 — $\frac{1}{4}$	$\frac{1}{2}$ — $\frac{3}{4}$	$1\frac{1}{2}$
<i>Lotus corniculatus</i>	0 — $\frac{1}{4}$	$\frac{1}{4}$ — $\frac{1}{2}$	$1\frac{1}{2}$
<i>Medicago lupulina</i>	0 — $\frac{1}{4}$	$\frac{3}{4}$ — 1	$1\frac{1}{2}$
<i>Onobrychis</i> (Sainfoin)	$\frac{3}{4}$ — 1	2 — $2\frac{1}{2}$	$4\frac{1}{4}$
<i>Poterium</i> (Burnet)	$\frac{1}{4}$ — $\frac{1}{2}$	$1\frac{1}{2}$ — $1\frac{3}{4}$	4
<i>Trifolium hybridum</i>	0 — $\frac{1}{4}$	$\frac{1}{2}$ — $\frac{3}{4}$	$1\frac{1}{4}$
— <i>pratense</i>	0 — $\frac{1}{4}$	$1\frac{1}{4}$ — $1\frac{1}{2}$	2
— <i>repens</i>	0 — $\frac{1}{4}$	$\frac{1}{2}$ —	$1\frac{1}{2}$

Mr. Sterling obtained these results by sowing the seed in finely-sifted dark loam, which was kept moist throughout the process of germination, to which is attributable the circumstance of many of the seeds germinating well, as is shown in Column II., even without a covering. The combination of such favourable circumstances of soil and moisture can, however, seldom be calculated on for field sowing, and a covering of mould, even for the smallest seeds, is

therefore always desirable; and the other columns show that many seeds must inevitably be lost from over depth of covering, unless the ground be in all cases carefully prepared and pulverized before sowing any of the grasses.

These seeds almost all belong to the grasses and clovers; it is however hardly necessary to add, that no advantage is gained in spring by covering the larger seeds with a deep covering of earth.

Beans, peas, wheat, oats, and barley, are none of them the better for having more than an inch of earth above them. Mangold wurzel, carrot, parsnip, and turnip seed, should not be covered by more than half an inch of soil.

The choice of seed hinges (1) on the character of the different varieties of each crop offered in the market, and for this the reader must refer to the description given of each; and (2) on the locality where the seed was grown; though on this point we believe that undue importance is generally placed.

Let it, in the first place, be admitted that a healthily grown, thoroughly ripened seed is perfect of its kind, and, these conditions being fulfilled, it matters nothing whether it be grown on chalk, or clay, or sand. A "change" from one geological formation to another, or from one farm to another, is not, as some seem to think it, necessarily an advantage. Healthily grown and thoroughly ripened wheat is to be had in any county in the kingdom; and if, having it, you have that which is perfect of its "kind," it is plain that you need not travel for a "change." The question, however, is—What of the character of a grain is involved in this term "kind;" and the answer we presume to be—All that it inherited or can transmit. Now nothing is more certain in agricultural experience than that besides those characters of plants which botanists admit as the permanent distinctions of species, there are other habits or features of greater or less permanence, which plants acquire by the constant treatment of the cultivator or the constant influence of habitat and climate, and which, though capable of alteration and ultimate extinction by other treatment, are yet not altogether transient, but will re-appear in subsequent seasons in greater or less degree, according as the circumstances of the locality or season are favourable or otherwise. Thus, we doubt not that a "kind" distinguished for several years under good cultivation for extraordinary productiveness, will be more likely than one of inferior character in this respect to yield well even under inferior cultivation. And the advice on this subject which we should offer would be, simply to look out for seed of a sort which has been known for many years to yield most bushels per acre of good grain. If it can be had from your neighbour, then you will be saved the trouble of sending to either end of the island for it.

There are, however, characters which grain from Sussex and from Aberdeen respectively are likely to bring with them in addition to

the quantity or quality of their produce; and if a choice must be made between the two, it must hinge upon the relative value of those characteristics which the respective climates of those counties are likely to have encouraged, and, as it were, imprinted. Is hardiness and ability to withstand severity of winter and spring especially desired? then seed from the northern county will probably be preferred. Is earliness of ripening desired? then, though this is probably a less certain character than the other, yet it is more likely to be found in grain from Sussex than in that from Aberdeen; and it is probable that the latter is generally in this country the most valuable character of the two.

The quantity of seed to be purchased for use upon the farm is to be obtained by multiplying the following quantities per acre by the number of acres to be sown. Wheat, $1\frac{1}{2}$ to 2 bushels; barley, 2 to 3 bushels; oats, 3 to 4 bushels; beans, $1\frac{1}{2}$ to 3 bushels; peas, 2 to 3 bushels; vetches, $2\frac{1}{2}$ to 3 bushels.

Sainfoin, 4 bushels (of the rough seed); turnips, 3 lbs.; mangold wurzels, 6 to 8 lbs.; carrots, 6 to 7 lbs.; parsnips, 5 to 7 lbs.

Mixed grass seeds, 40 to 50 lbs. But of these, and other crops, details will be given at their respective seed times.

II.—ARTIFICIAL MANURES.

The use of auxiliary manures upon the farm is now almost universal. On the light soils of the chalk districts and elsewhere in England, it is the common practice to apply almost all the farm manure to the clover stubble before ploughing it up for wheat, to purchase superphosphate of lime for the turnip crop, and to consume large quantities of cake and corn by sheep folded on those turnips, thus manuring the land for the succeeding barley crop. In the north it is more common to break up the clover and grass for oats, to apply the dung of the farm to the green crops, turnips, potatoes, &c., and to purchase guano and other manures for dressings both to green crops and to the wheat.

There seems a greater need for the use of ammoniacal manures in the case of turnips in the Scottish climate than exists in the south. Probably the best practice on the lighter soils of south and midland England would be to give barely half a dressing of dung in spring to all the land for turnips, along with three cwts. of superphosphate of lime per acre; to give a full dressing of farm dung in autumn to the land for the mangold wurzel crop, along with two or three cwts. of guano and two or three cwts. of common salt per acre in spring; to give a fair dressing of dung, in autumn if possible, to land intended for potatoes, along with two or three cwts. of guano as a top dressing in spring at planting time; to give a fair

dressing of dung to the clover in autumn for the wheat crop ; to give a fair dressing of dung in autumn for the vetches, beans, and perhaps peas ; and to give, if anything, one cwt. of nitrate of soda now, or very soon, per acre to all the spring-corn requiring it. Barley after turnips fed on the land will need no such dressing.

In the case of an eight-field rotation you would, according to this, need for every 200 acres—in 1, wheat ; 2, turnips ; 3, barley ; 4, clover ; 5, wheat ; 6, mangold wurzel ; 7, oats ; 8, beans respectively—seventy-five cwts. of superphosphate, sixty cwts. of guano, and probably twenty cwts. of nitrate of soda per annum. You would grow about 200 tons of straw, which might make, by the aid of compost additions, 1200 tons of dung—equal to twelve tons per acre for all your wheat, six tons per acre for the turnips, twelve tons for the mangold wurzel, and six tons for the beans ; and these quantities, supplemented by the purchases just named, would keep the soil in ample fertility. On the perfect fitness of these artificial manures to the growth of turnips in our southern English climate, take the following from Mr. Cubitt, Bacton Abbey, Norfolk :—

“There is no doubt that the farmers are humbugged by artificial manures to the extent of some tens of thousands annually ; but for the last ten years I have used home-made superphosphate with bones dissolved on my own premises, and under my own inspection, and having tried various other manures, I have come to the conclusion that, as an artificial manure, there is nothing equal to the home-made superphosphate. I must, however, caution farmers as to how they use it. I have heard many farmers having good land say it is throwing money away to use artificial manures ; and the reason of this is that too much farm-yard manure is used with it. I can grow as good a body of Swedes with the artificial manure and six or eight loads of farm-yard dung, as I can with that quantity of artificial manure and three times the quantity of farm-yard dung. A very small quantity of farm-yard dung, with six bushels of dissolved bones, will grow a good body of turnips.”

It is the liability of our artificial manures to adulteration that is the great difficulty in the way of their extended use. The remedies are—

1st, To deal with men of well-known probity. 2nd, To send a sample of the manure purchased to a chemist for analysis, and ascertain by the table below the commercial value of the article. 3rd, The farmer may manufacture his own superphosphate, and this can easily be accomplished in the following manner :—Procure a large shallow vat, in which place ground bones—boiled bones being the cheapest and best ; wet them to saturation with their own weight of boiling water, after which add one-third their own weight of brown sulphuric acid, which costs $\frac{3}{4}$ d. per lb. As the action of the acid on the bones goes on for some days, the mass should be

frequently stirred ; and when the work of solution ceases, the mass may be dried with fine dry mould. If it be done on the large scale, for the large shallow vat, there may be substituted a hard floor of clay, with a rim of ashes to mix with the superphosphate after it is made.

The following table gives the valuation per ton of the several ingredients of a manure, as they are supplied from various sources in the market—according to the estimates of several of our best authorities on this subject :—

Value per Ton of	Way.	Hodges.	Nesbit.	Anderson.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Ammonia	56 0 0	56 0 0	60 0 0	56 0 0
Insoluble phosphates	7 0 0	7 0 0	8 0 0	7 0 0
Soluble phosphates...	32 13 0	25 0 0	24 0 0	28 0 0
Potash	30 16 0	20 0 0	...	20 0 0
Alkaline salts	1 0 0	1 0 0	1 0 0	1 0 0
Organic matters	1 0 0	0 10 0	1 0 0	...

These figures enable us to ascertain the real worth of any manure of which we have an analysis.

If a guano, for instance, contains seventeen per cent. of ammonia, then, by multiplying the market price of ammonia per ton by seventeen, we get the value of 100 tons of the guano in question, so far as its ammonia is concerned. And pursuing the same plan with its other ingredients, we arrive at the whole price of the 100 tons of the manure in question, which it is easy to divide by 100, so as to ascertain the price per ton which we are justified in giving for it.

An authentic analysis is thus sufficient guide to the price which ought to be given for any purchased fertiliser. When no analysis is given, a simple experiment sometimes is enough to determine the genuineness of the article. Perhaps the simplest test that can be applied to guano is that of weight. A bushel of good guano, filled in without pressure, should not exceed seventy-three lbs. in weight—it may vary from sixty-nine to seventy-three lbs., and the lighter the better; provided, on throwing it into water, none of it floats, for that would show an admixture of sawdust. If heavier than seventy-three lbs. per bushel, it has been adulterated with earth. Superphosphate of lime is another manure especially liable to adulteration, but a guaranteed analysis is in this case almost always offered with the purchase. When no analysis is given, properly attested samples sealed up in bottles should be taken ; and if a failing crop should lead you to suspect roguery, these may be analysed, and will enable you to obtain damages from the dealer or manufacturer in a court of law.

As to the use which is to be made of these fertilisers, it is to be observed generally that all soluble manures, such as common salt, sulphate of ammonia, nitrate of soda, are to be applied during the season of growth; while the less soluble manure, as guano, superphosphate, &c., may be applied earlier in the season; and bone dust, farm-yard dung, &c., still less immediately active, may be added in the autumn or during winter.

The following memoranda indicate the usual quantities applied and the usual crops to which they are applied.

Name of Manure.	Applied to	Weight per Acre.
Guano	All crops.....	1 to 3 cwt.
Superphos. of lime...	Turnips	3 ,, 5 ,,
Com. Salt	Grain crops and M. wurz.	2 ,, 4 ,,
Soot.....	Grain crops, potatoes, &c.	30 ,, 40 bush.
Sulphate of ammonia	Grain crops.....	1 ,, 1½ cwt.
Nitrate of Soda	Ditto	1 ,, 1½ ,,
Gypsum	Clover, potatoes, &c.....	10 ,, 20 ,,
Rape cake	Grain crops, &c.....	6 ,, 8 ,,
Bone dust	Turnips, grass land, &c..	12 ,, 16 bush.

Mr. Lawes has recently published his experience, which is larger than that of any other man, of the best use that can be made of artificial auxiliaries to the manures of the farm; and we quote the following passages.

a. On the availability of ammoniacal manure for cereal crops and leguminous crops:—

The records of nearly twenty years of experiments at Rothamsted, have not afforded a single instance in which the application of ammoniacal salts to a *cereal* crop has failed to give a greater or less increase of produce. This is the case even where there has been a very unusual exhaustion of mineral constituents; and this effect of ammoniacal salts is quite consistent with that observed when such crops are cultivated and manured according to the ordinary course of practice. On the other hand, experiments continued for more than half that period with *leguminous* crops, such as clover and beans, as well as practical experience with such crops, show no such result on the direct application of ammoniacal manures.

It is, in fact, bad practice to apply Peruvian guano, or ammoniacal salts, to a bean or a clover crop; and where dung is applied both to the wheat and bean crops, true economy would suggest that the rich oil-cake dung be employed for the wheat, and that which is poorer for the beans and clover.

b. Manure for Wheat.—On the heavier descriptions of land, two to three cwts. per acre of Peruvian guano is the best manure for this crop. It should be sown broadcast before the seed, and harrowed

in. It is sometimes mixed with twice its weight of common salt, by which, as well as by ashes or other matters, a more equal distribution through the soil is attained. On lighter soils the best farm dung is the best manure for the wheat crop.

c. Manure for Barley and Oats.—When either of these crops follows a root crop which has been partially or wholly removed from the land, a mixture of equal parts Peruvian guano, or nitrate of soda, or sulphate of ammonia, with superphosphate of lime, may be used with advantage. The selection of one or other of the three nitrogenous manures mentioned should depend in some measure upon the comparative cost of each at the time. About one cwt. of the guano, nitrate, or sulphate, and one cwt. of superphosphate of lime, will generally be sufficient for an acre. The manure should be sown before the seed, as recommended for wheat. When one corn crop follows another, as oats after wheat, about twice as much of the artificial mixture should be used as under ordinary circumstances. When corn crops require to be top-dressed late in the spring, nitrate of soda is the best manure to employ; one to one and a half cwt. per acre being used.

d. Manure for Meadow Hay.—To grass land mown for hay, from eight to ten tons of rotten dung should be applied once in about every four or five years, in the month of November. The artificial manures most suitable for grass land, are, Peruvian guano, salts of ammonia, and nitrate of soda. When either of these manures is used alone, the following quantities may be applied:—

Peruvian guano	2 to 2½ cwt. per acre,
Salts of ammonia	1 „ 1½ „
Nitrate of soda	1 „ 1½ „

One cwt. of nitrate of soda, mixed with one cwt. of superphosphate of lime, is also a very good manure. Or, a mixture of equal parts of Peruvian guano, ammonia salts, nitrate of soda, and superphosphate of lime, applied at the rate of two cwt. per acre, is perhaps the most generally useful. In deciding upon the exact combination to be employed, some regard should be had to the relative cost of the several substances at the time, as it varies considerably from season to season.

The best time to apply the artificial manures is from the end of January to the middle of February; if the application is delayed much later than this, nitrate of soda is the best manure to employ.

e. Manure for Mangold Wurzel.—This crop requires to be liberally manured. The best dung at command should be employed; ten, fifteen, or even twenty tons per acre, being spread after the land is drawn in ridges, and previous to their being split; and two to three cwt. of Peruvian guano mixed with twice its weight of common salt, should be strained by hand on the top of the dung. Common

salt appears to act more beneficially as a manure for mangolds than for any other crop of the farm ; it also produces marked effects upon the growth of asparagus in our gardens. Both plants are in fact indigenous to the sea coast.

f. Manure for Potatoes.—It is the general practice to dung heavily for potatoes. Although the crop might not be so large, it is probable that if potatoes were taken after some other crop well dunged, instead of the dung being applied directly for their growth, they would be less liable to disease. Supposing this plan adopted, three to four cwts. per acre of an equal mixture of Peruvian guano and superphosphate of lime should be used for the potatoes. Or, in case of dung being employed, the best mode of application would be to plough it into the land in the autumn, the potatoes being set in the following spring.

g. Manure for Turnips.—When Swedes, or common turnips, follow a corn crop which had been manured by farm-yard dung, the roots may be grown by artificial manures alone. From two and a half to three cwts. of superphosphate of lime should be drilled with the seed ; and in the case of Swedes (except when sown late, or if the land be considered in good condition) from two to three cwts. of Peruvian guano may be used in addition. If the preceding crop has not been manured by dung, seven to ten tons per acre should be applied ; two and a half cwts. of superphosphate of lime being drilled with the seed ; and if the dung used be poor, two cwts. of Peruvian guano may be strained over it in the drills. Or, where no manure drill is employed, the superphosphate of lime may be sown broad-cast after the dung is spread, either alone, or mixed with guano, as the case may require. These manures do not react injuriously upon each other when mixed together ; but the guano is liable to be injurious to the young turnip plant if brought in close contact with it. Hence, when guano and superphosphate of lime are mixed together, and sown by the drill, two or three inches of soil should intervene between the manure and the seed.

III.—BARLEY CULTURE.

This was pretty fully discussed last month. It remains, however, to give illustrations of some of the leading varieties of this grain in Figs. 24 and 25. Drawings of the natural size are given of six of our principal sorts of barley.

In Fig. 24 three full-sized ears are represented :—*a*, Annat barley ; *b*, Chevalier barley ; *c*, common English barley ; all described at pages 105 and 106.

In Fig. 25 are shown *d*, Fan or Sprat Battledore barley ; *e*, Victoria Bere ; *f*, six-rowed barley.

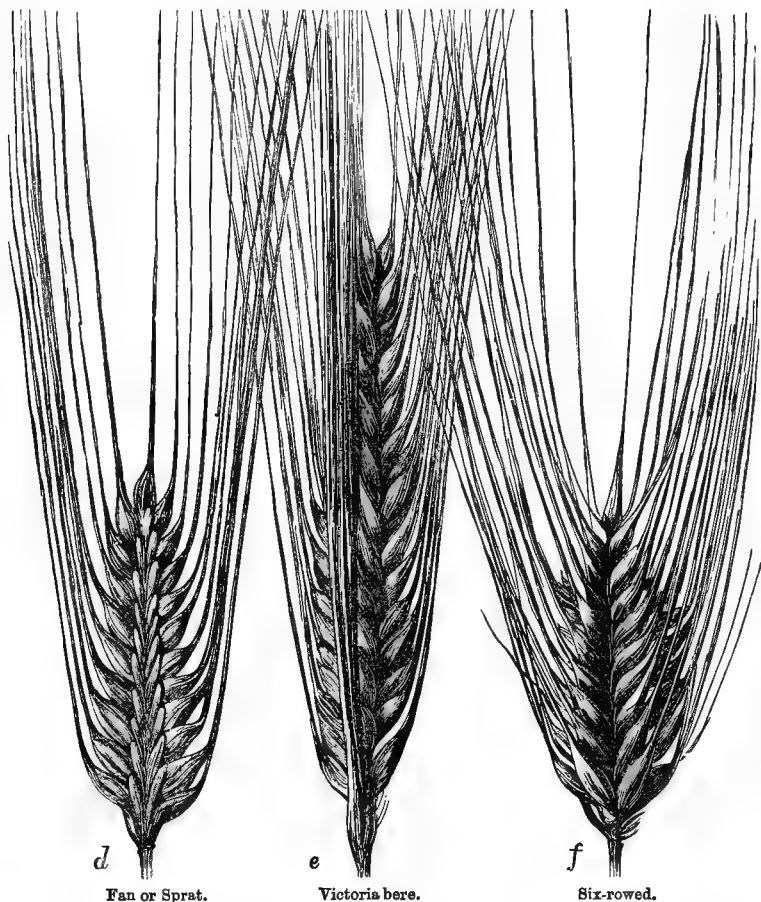
Fan or Battledore barley is a short-strawed variety of no parti-

Fig. 24.



cular agricultural merit; but noteworthy for the curious form and width of the ear.

Fig. 25.



Victoria bere has a longer ear upon longer straw, and yields grain of a better quality than the common, Bere or Big, which is commonly cultivated in late climates, in Ireland and the Highlands of Scotland.

The six-rowed barley has a much shorter ear, and yields a coarser grain.

March is the proper month for getting seed barley into the ground. Crops later sown may be good, but, if all circumstances

be equal, the March-sown will be superior to any at a later season. It is sown commonly after turnips, which root will not last for feeding upon the average of seasons longer than the middle of this month. I am not here asserting that April is improper for sowing barley; I know the contrary from experience; but if soil and circumstances are equal, a March sowing will exceed an April one, on an average of several years, by three or four bushels in the crop. March may, however, pass away without a ploughing season for wet lands in the whole month, and advice to sow barley in March must therefore always be under the proviso that the land is dry enough for ploughing.

On clay, or other heavy soils which will not bear sheep, barley, if grown at all, should be sown after a scarifying, in the first dry season, whether in February or March. In some clay countries, the farmers still bare-fallow their land, and lay it up in narrow ridges, well water-furrowed for the winter. In a hard frost they carry on their dung, and leave it in heaps till sowing time, when they spread before the ploughs. The same practice is adopted after beans, peas, vetches, potatoe, or carrot land: all which crops are taken up in autumn, and the land is ploughed after them into ridges and well water-furrowed, ready for spring sowing. In such cases the great point is, to have the soil, previous to the crop, in such good order, that no other spring tillage than the seed earth, or scarifying, may be necessary.

Whatever rotation of crops be adopted, barley almost always follows an ameliorating crop, and must generally be followed by clover.

Barley after Turnips.—When it comes, as it generally does, after turnips, if they were not drawn and carted, or not eaten by sheep, in time enough to allow sowing with barley in February; or if the farmer does not approve of sowing this grain early, by reason of the quality of his soil; March may be the principal period of his barley-sowing. As the fields are cleared, much attention should be given to the state and temper of the surface. In this respect more attention is necessary now than in February, as the advanced state of the season has lessened the chance of frosts, which are more effective in giving friability than any other circumstance. If the scarifier works well, or is likely to work well, by the 20th, its use should preclude the plough; but if, from the state of the surface, compared with that of the soil at the depth of five inches, it appears that a ploughing is really necessary, in such case the prudent farmer will, of course, give it. His grand object is to avoid turning down a surface which is in a friable state, and bringing up another which will harden, by north-east winds, into *clods of brick*, as they may then be called. He should keep in recollection, that if the last earth for the turnips turned down a manuring, it is better situated for safety against sun and wind, than if brought to the surface by

a new ploughing; that it lies where the barley-roots will find it; and that the urine of the sheep sunk in the soil, is less liable to evaporation without than with ploughing.

The quantity of seed barley to be sown per acre and the mode of committing it to the ground were referred to last month. As to dressings of artificial manures, more necessary in the later than in the earlier sown barley fields—and not necessary at all where turnips fed off by sheep have been the preceding crop—Mr. Lawes' experience has been given in a preceding page.

IV.—SPRING WHEAT.

March is the latest month proper for sowing wheat; there is indeed a kind called April wheat, but though it may be sown in accordance with its name, it is better put earlier into the ground; and it will generally be better policy to put barley into land fit for the sheep-fold, which is generally the only cause for delaying the seed-time till so late a time of year. Both Talavera and April wheat will be illustrated along with other sorts in one of the autumn months. The former is a productive kind, of good quality, remarkable for the distance between the florets and seeds upon the ear, which gives it a thin and half clothed appearance. The other is recognisable by its spreading awns and its red colour; it yields a grain of fair quality, and is very rapidly growing in favour in all late cold districts. Towards the end of March young wheat may be rolled and hoed; and top-dressings of manure, nitrate of soda, or guano, or sulphate of ammonia may be applied this month. On this subject remark has been made at page 141.

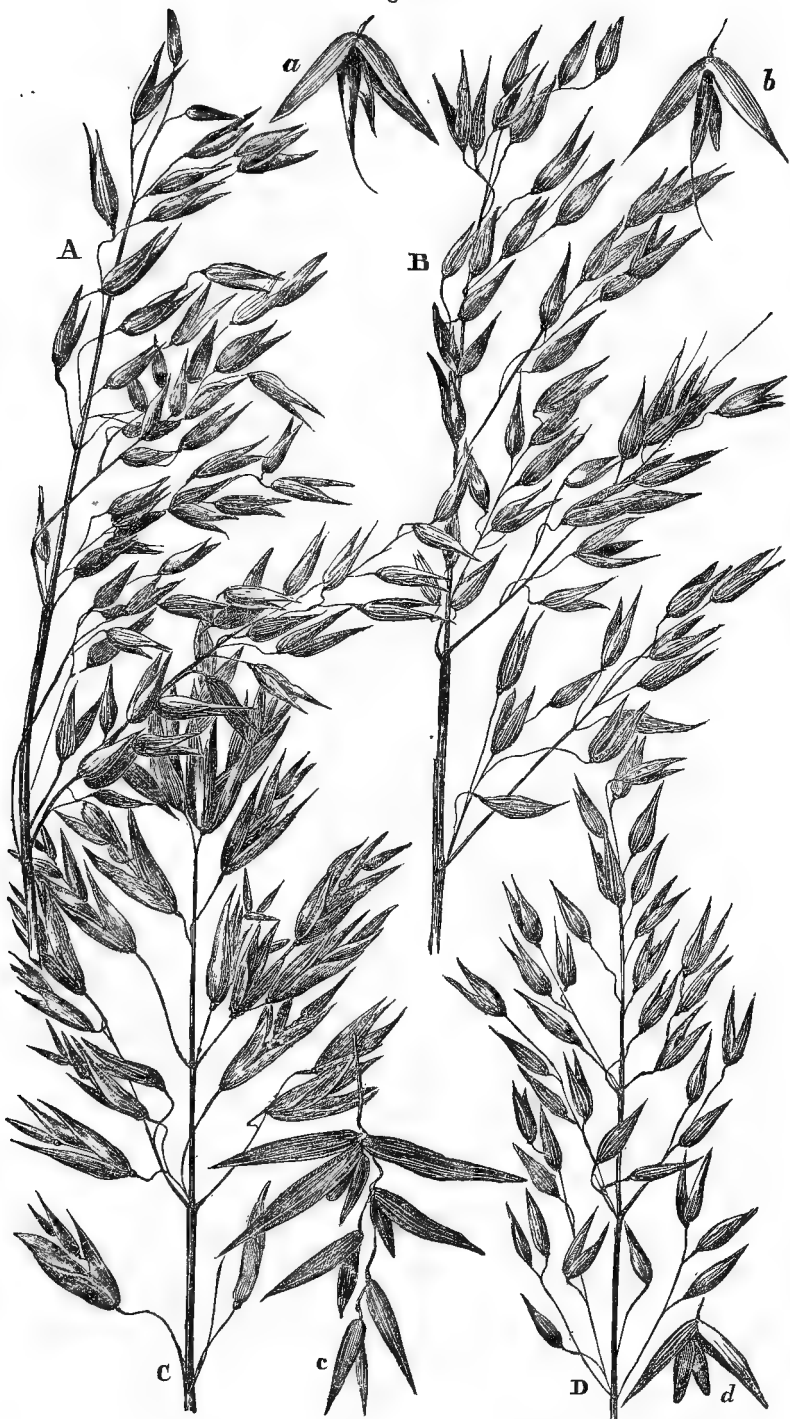
V.—OATS.

We give the following illustrations of sorts commonly cultivated. The ears are drawn of half the natural size, and there is a floret beside each given of the full natural size:—A, White Tartarian Oat; B, Black do.; C, Naked Oat; D, Hopetoun Oat; E, Sandy Oat; F, Poland Black Oat; G, Potato Oat; H, Barbachlaw Oat.

These, and other specimens of plants drawn in this book, have been obtained from the museum of Messrs. Lawson and Son, of Edinburgh. The specimen of Hopetoun Oat which has been drawn hardly does justice to the ordinary more vigorous growth of the variety.

The Tartarian White Oat is a coarse thin grain, rarely reaching 40 lbs. a bushel, but yielding a very bulky crop of both straw and grain. It is grown a good deal in the southern counties, and in the chalk districts. It is very late of ripening, and therefore unfitted for late climates and poor soils. The *Black Tartarian* is shorter-strawed

Fig. 26.



(A, B) White and Black Tartarian Oat.

(C, D) Naked and Hopetoun Oats.

than the white variety, much earlier in ripening, and fitted therefore for later districts and poorer soils.

The *Naked Oat* is a very prolific sort, more liable, however, to loss by wind at harvest time than other kinds; and therefore not coming into favour, though it has long been known to English agriculture.

Fig. 27.



E) Sandy Oat.

(F) Black Poland Oat.

The *Hopetoun Oat* is one of many agricultural plants which are due to the energy and patient perseverance of Mr. Patrick Shirreff, of East Lothian. It is a tolerably early oat, with a large panicle, and hardly therefore properly represented in our drawing (D, Fig. 26). It yields a heavy grain and very long straw—its seed is dis

Fig. 28.



(G) Potato Oat.

(H) Barbachlaw Oat.

tinguished by a small ruddy mark on its front, and its straw acquires a reddish hue as it ripens. It is well adapted to lately re-

claimed land and the lighter class of soils, and has come largely into cultivation.

The *Sandy Oat* (E, Fig. 27), of Aberdeenshire origin, has been in cultivation for the last twenty-five or thirty years. It has a smaller grain than some other kinds, but yields well, and possessing a remarkably stiff straw is especially adapted to soft and peaty soils.

The *Poland Oat* is a very short-strawed and very early variety, and as such better able than other sorts to meet the difficulties of late districts and rich soils. The black variety of this oat is represented at F. Fig. 27.

The *Potato Oat* (G, Fig. 28) has long been in cultivation. It is rather a short-strawed sort, and yields the very best quality known to English agriculture. Its grain is short, and round, and white; the ear is somewhat compact. It is less adapted than some other sorts to the more clayey soils, and it is more liable on such soils to a disease called the *tulip root*, which is sufficiently described by its name. Potato oats are liable to shed at harvest time, and should be cut before the straw has entirely lost its green colour.

The *Barbachlaw Oat* is a hardy and prolific sort, adapted for late climates and moorish soils. It yields a coarse thin grain, but is very productive both of straw and seed.

Besides the oats thus named and illustrated, many others are known to Scotch and English farmers. Among them we may enumerate—the *Angus Oats*, the common *Dun Oat*, the *Berlie* and the *Canadian Oat*. The last-named is this year (1861) being largely cultivated in some of the southern counties, having acquired a high reputation in 1860 for the quality and quantity of its yield, notwithstanding the difficulties of an unusually wet season and harvest time. Forty-six pounds per bushel were a common weight for the Canadian Oat last year.

White oats should be sown now, in preference to any other season; and, in the general conduct of them, the farmer should, as a general rule, avoid sowing them after other corn crops, by which they exhaust the land. They should receive the same preparation as barley.

What good reasons are to be offered, for sowing oats on land in such bad order that barley is not to be ventured in, I know not. The common argument is their hardiness, which will give a middling produce, about sufficient to pay expenses, and leave a trifling profit, when no other crop will do the like.

The question between barley and oats depends, first, on the relative price. Oats may be expected to yield two quarters or more per acre more than barley; it is therefore easy to calculate, at given prices, which grain will pay the farmer best; but it is not to be forgotten, that barley generally leaves the soil in much better heart than oats leave it, the latter being a more exhausting crop.

Oats on Lays.—It is very common husbandry to put in oats on one ploughing of old grass, and on layers of shorter duration. The method is, to plough the land as early as possible, drill-press, if necessary, sow oats broadcast, and harrow them under. And in Scotland the almost universal practice is thus to take oats after grass or clover. In England wheat is the more common succession. But in very many cases it is better to put peas in on light land, and beans on stiff soils, and to follow these with oats or wheat, according to circumstances. I have known oats which had produced inferior crops, followed by oats again the next year, and produce largely, which proved that they wanted *tilth*. Peas or beans will rather improve than exhaust land, when put in thus on layers; whereas two crops of oats will scourge the land too much.

Let it, however, be well remembered, that these observations are made (so far as they relate to old grass) on the supposition that the farmer will not, or is not allowed, to pare and burn, a method much superior, and which ought to be pursued in all cases where it is practicable.

A reference to the ordinary cultivation of the oat crop is made at page 105. As to the quantity of seed required, two bushels per acre of the better kinds, as Potato and Poland Oats, will be as large a seeding as four bushels or even more of the lighter awny sorts—the Tartarian varieties, for instance.

VI.—CLOVER.

There are several methods of sowing clover seed.

1st. It may be sown broadcast and harrowed in at the time the barley is drilled; a pair of light harrows at the same time following the drill-machine, to cover the clover seed.

2nd. It may be sown before the roller, when the barley is just above the ground.

3rd. It may be hand or horse-hoed in when the corn receives either of those operations, if the farmer is in the practice of giving them.

Of these methods, the first is the surest for a crop, and the most to be recommended, notwithstanding the admitted evil which sometimes takes place in a wet season, of the clover growing so luxuriantly as to damage the barley. The second succeeds well, if rain follows in due time, and would, perhaps generally succeed, if the farmer ventured to harrow it in, which he might safely do. In the third method it often succeeds, but it also often fails; nor is it necessary, in many cases, to hoe the barley.

In any case it is best sown with a handbarrow covering five yards in width; and if this be set to sow one half of the quantity per acre that is wanted and made to cover the ground twice, the work will be more perfectly done. If grass seeds be sown with the clover then

another sowing will be necessary with the same tool set for grass seeds. It is covered in by a light harrowing with either the bush or web harrow, or light-seed harrows of the common kind, and rolled. Of the seeds sown at this season we have—1. Trefoil sown fourteen to sixteen lbs. per acre alone in some districts as one of the earliest foods for ewes and lambs in spring. It is ploughed up after a first folding, and a crop of turnips may be taken. 2. Red clover or cow grass sown often by itself as affording a heavy first cut later in the summer for forage for the stalls or stable—coming in for this purpose after the trefolium incarnatum. 3. Various mixtures of clovers, as for instance, ten lbs. of red clover, four lbs. of white clover, four lbs. of trefoil. The red clover is a large seed, the white clover a much smaller one, so that four lbs. of it contain as many seeds as ten lbs. of the other; the yellow blossomed trefoil is the largest seed of the three. This I have found to yield a first, second, and third cut during the summer—the latter cuts containing, however, more of the white and yellow clovers. The alsike clover is coming into use partly as a substitute for the white; it is equally perennial, and has a larger habit of growth.

In all moister and later climates grass seeds may be sown with the clovers. And the following table of quantities and kinds to be sown per acre is extracted from Lawson's *Agrostographia* :—

	Light and Medium Soils.			Heavy Soils.		
	1 Year's Hay.	1 Year's Hay and 1 Year's pasture.	1 Year's ⁸ Hay and 2 Years' pasture.	1 Year's Hay.	1 Year's Hay and 1 Year's pasture.	1 Year's Hay and 2 Years' pasture.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Common Rye-grass.....	18	18	18	18	18	18
Meadow Cat's-tail	...	...	...	1	1	1
Common Red Clover...	8	6	3	8	6	3
Cow Grass	...	...	3	...	...	3
White Dutch Clover....	2	4	4	2	4	4
Yellow Clover	...	2	2	...	2	2
	28	30	30	29	31	31

By substituting five lbs. of Italian for eight of common rye-grass in the above table, it will be improved. These seeds may be sown in two lots, as we have suggested, immediately after the barley; or you may delay it for three weeks, and let the young barley up, and then sow and hoe in: this affords an opportunity for hoeing and cleaning the land somewhat later in the season.

This subject was lately discussed before the East Lothian Farmers' Club; and we add here the remarks of some of the speakers, descriptive of experience in that county. Mr. S. Shirreff, of Saltcoates, said:—"Before sowing out a field, it must be as clean as

possible, and in very high condition. If it is intended for cutting, then give a larger proportion of red clover—say fourteen lbs.—a little yellow, and a mixture of rye-grass, Italian being preferred.” He thought he had erred in giving too little Italian rye-grass. The following were the proportions in which he mixed his grass seeds:—For cutting—14 lbs. red, 2 lbs. alsike, 2 lbs. yellow, 2 lbs. white, and 3 pecks rye-grass. For pasture—8 lbs. white, 4 lbs. red, 2 lbs. yellow, 2 lbs. alsike, and 4 pecks rye-grass.

Mr. Hope, of Fenton Barns, has been in the habit of sowing his young grass after two green crops, and he does so for the purpose of cleaning the land, and putting it in good condition. He finds that the young grass comes away better after potatoes than after turnips, and in the neighbourhood of Edinburgh the farmers are in the habit of sowing it after potatoes. The following is his mixture, which is calculated by the Scotch acre (about $1\frac{1}{4}$ imperial):—

For pasture, one year or two—11 lbs. red clover, 4 lbs. white, 2 lbs. alsike, 2 lbs. yellow, 2 pecks Italian rye-grass, and 1 peck perennial. For cutting—12 lbs. red clover, 2 lbs. white, 2 lbs. alsike, 2 lbs. yellow, and 1 peck perennial, or 2 pecks Italian. The 2 lbs. white might be omitted; it does little good in cutting grass.

Mr. Wilson, of Edington Mains, Berwickshire, uses for cutting-grass—

Half a bushel of Italian rye-grass, and 14 lbs. red clover. For grazing, either one or more years—1 bushel of Italian (or, instead, a half bushel perennial and a half bushel Italian), 8 lbs. trefoil, 4 lbs. white, 2 lbs. alsike, and 1 lb. parsley. Mr. Wilson’s experience is much in favour of Italian; and he thinks less and less of common rye-grass as a pasture plant. Mr. Wilson has been successful in sowing grass crops for a good many years. His red clover he always obtains from the grower. He never sows any of his clover or grass seeds until about the third week of April, by which time the grain is usually well braided. He is also very particular about the mode of covering in his grass seeds. When the surface is at all rough, he is in the habit of rolling it with a one-horse roller before sowing the seeds; and he afterwards covers them in with a Cambridge roller, to which thorn bushes are attached.

Mr. Usher, Stodrig, Kelso, uses the following per imperial acre:—

For grazing—12 lbs. yellow, 4 lbs. red, 4 lbs. white, and a half bushel rye-grass. He approves of yellow clover being sown thick. It keeps in the other clovers, and also feeds even better than white, if not allowed to become too luxuriant. In grazing for one year, he finds the stock, especially sheep, eat annual rye grass much better than perennial. For cutting, he uses nothing but red clover and annual rye-grass.

Mr. Stewart, Kirkchrist, Kirkcudbright, an excellent authority, uses the following mixtures per Scotch acre:—

For cutting—2 bushels rye-grass, 3 lbs. Timothy grass, 6 lbs. red clover, and 3 lbs. yellow. On light, dry land, to be grazed two or more years—2 bushels perennial rye-grass, 2 lbs. Italian, 2 lbs. Timothy, 4 lbs. white clover, 2 lbs. yellow clover, 2 lbs. cow grass, and 2 lbs. alsike clover. On drained land, to be grazed three years—2 bushels perennial, 2 lbs. Italian rye-grass, 3 lbs. Timothy, 3 lbs. each of the white and yellow clovers, 3 lbs. cow grass, and 1 or 2 lbs. alsike clover.

The usual mixtures sown in Dumfriesshire, are as follows :—

For one year's pasture—8 lbs. red clover, 6 lbs. white clover, 2 lbs. yellow clover, 2 pecks rye-grass, and 2 pecks Italian grass. For two years' pasture—8 lbs. red clover, 4 lbs. cow grass, 4 lbs. white clover, 2 lbs. alsike clover, 2 lbs. yellow clover, 2 pecks rye-grass, and 2 pecks Italian grass. For cutting or hay—14 lbs. red clover, 2 lbs. white clover, 2 lbs. yellow clover, 2 pecks rye-grass, and 2 or 3 pecks Italian grass.

Mr. Durie, Standingstane, at this meeting expressed astonishment, as well he might, at the great diversity of practice that existed. Some sow upwards of two bushels of rye-grass, and some merely two pecks. They cannot all be right. Mr. Hope uses a very small proportion of rye-grass; and Mr. Durie's experience is, that the quantity used had been diminishing of late years. His father used to sow about a bushel and a half; but he afterwards came down to one bushel, and now he never goes the length of a bushel. In sowing Italian grass, his experience has been that where much of it is used it has a tendency to keep the clover from growing; and his practice now is never to sow more than two pecks. He never sows perennial grass, regarding it as a weed. If animals can get anything else they will never eat it. The first thing that convinced him of this was when his men had, unknown to him, sowed five acres of a field with annual instead of perennial grass. Next year, on the grass coming to pasture, he was much surprised to find that one portion of the field was eaten quite bare; and, on making inquiry, he learned for the first time of the mistake that had been made. The cattle had eaten quite bare all that portion of the field sown with annual grass, and allowed the rest to go to seed. From that time he has never sowed perennial rye-grass, either for pasture or cutting. His proportion now is very nearly the following per acre of every kind of clover for grazing:—4 lbs. each of red, white, yellow, and alsike. He would use a larger proportion of alsike, but for two reasons. In the first place it is late, and in the next place it is very dear; but after it comes away, it makes excellent pasturing grass. It is a great pity to see that the red clover is disappearing. He has almost given up growing it, for it never succeeded with him above once out of five times. If anybody tried the proportions of clover which he had indicated, and

added two pecks of Italian and one of annual grass, they would, if the land was in fair condition, secure a first-rate pasture.

Mr. Douglas, Athelstaneford, thought that two pecks of Italian rye-grass was quite enough, whether it was for the purpose of protecting the slower growing plants, or of securing an early bite in spring. When he attempted more Italian, he found, from its rapid growth—if the clover plant was not very healthy—that it was very apt to overcome the clover, and destroy it, especially if it had been top-dressed. With regard to perennial grass, he never now sowed it—he did not believe in it. The annual was a better-growing grass, more succulent, and grew a heavier crop. It was not so wiry and hard as the perennial, and therefore he never sowed the latter. As to clover, there was a great difference of practice, arising, he supposed, from differences in soils and in situations. He knew one gentleman, a very successful grower of clover, who never sowed above six lbs. per Scotch acre; and yet he said that he had always his surface well planted. His (Mr. Douglas's) mixture for all purposes was—10 lbs. red clover, 4 lbs. white, 2 lbs. cow's grass, and 2 lbs. alsike. Two lbs. of alsike are sufficient of itself to plant an acre, as it is a small seed; and he thought if any person used more he was using too much. The result of his experiments went to show that the alsike is quite equal to the red clover as pasture, while it is a very good substitute for green forage or hay. It is a free grower, and has the advantage of being new to the soil; and, when land is clover sick, and throws out the plant in the winter and spring months, it enables the farmer to follow the regular rotation of cropping. He thought the six-break system was a great advantage to the successful growth of clover compared with the four, as by extending the period of growing the plant, and having a greater alternation of cropping, there is much greater chance of the crop succeeding.

We give this discussion in some detail as describing good practice in the North. It must be added, that in the Southern counties Italian rye-grass, except under special culture, *i.e.*, growing it on excessive manuring, acquires a wiry, benty habit, and does not yield that full, luxuriant herbage which it elsewhere exhibits.

The unfortunate circumstance which attends clover, is its being extremely apt to fail in districts where it has been long a common article of cultivation. The land, to use the farmer's term, becomes *sick* of it. After harvest he has a fine plant, but by March or April, half, or perhaps more of it, is dead. This makes a new course of crops necessary. Instead of its occurring once in four years, as in the common Norfolk course, it becomes necessary to sow it only in the second round alternately, beans after barley in one course, and clover after barley in the next. This has been found in a great measure to meet the evil. On light soils, too, it is well to tread the young

seeds in autumn and manure them.* The evil has been variously explained; by some on the score of too frequent an extraction from the soil of those substances needed by the plant as food—this, however, in the face of experience in the field and garden cannot be maintained; by others, on the score of too great looseness in the soil which seems during winter to be fatal to the plant; and, again, by the Rev. M. J. Berkeley, on the ground of the soil retaining within it, if the plant be taken at too short intervals, the germs of certain parasitic moulds which, if not suffered to die out, take the first opportunity of the recurrence of the crop to which they are fitted, for their destructive attack.—Fields of young clover and grass should be picked free of large stones and rolled some time during March.

Trefoil is largely sown in some districts by itself, at the rate of sixteen or eighteen lbs. of seeds per acre, for the early sheep feed it affords. This is especially the custom in districts where the practice of fattening early lamb prevails. It, sown now, and rye sown in September, are generally the best keep for sheep at hand towards the end of the following April.

VII.—SAINFOIN.

This is the principal season for sowing sainfoin, and if the reader has land that will produce it, he can apply it to no crop of its class equally profitable. Chalky soils and sands upon chalk are its favourite soils; also loams, and clays, if not too stiff or too deep, on limestone. It does well, too, on very dry sound gravels, but not if the understratum be much mixed with clay. I have tried it without success on good dry turnip loams, but on every species of chalk and white marl its success is certain. The profit far exceeds that of any other similar use of such a soil. On poor sands in Norfolk and Suffolk, worth only 5s. an acre, the crop, for several years (after the first) has been from one ton to two tons and a half per acre, of excellent hay, and mown every year. Whatever the price of hay may be, such a produce on such land is prodigious, with the additional circumstance of an aftergrass extremely valuable for weaning and keeping lambs. I know not a more lamentable circumstance than to see such poor soils yielding a beggarly product in corn, other grass, and turnips, with not one acre of sainfoin, where there ought to be an hundred.

Sainfoin, on extremely favourable soils, will get the better of weeds, but it is always right to sow it with barley after turnips; four bushels an acre of the rough seed broad-cast, but three are enough drilled. If with drilled barley, the best way is to drill the corn first, and then the sainfoin across the former drills.

* See Lawrence's "Handybook for Farmers." Longmans.

VIII.—VETCHES.

If the weather in February did not allow sowing spring tares, or at least all the crop, the work must not be delayed longer than March, otherwise the crop will suffer. The best way is to plough the land flat, or in broad lands, and harrow in the seed: the soil should be dry before the ploughs go on it.

Sowing on a stale furrow is much superior to a fresh ploughing. If the land was ploughed before the Christmas frosts, and the weather in February has been favourable to the vegetation of weeds, some may have appeared, but the scarifiers or scufflers will destroy them, and working only in the dry pulverized surface will prepare for the seed much better than ploughing. Let it be remembered, that the necessity of a succession of vetch crops (which may be continued through all the spring) depends on the farmer's being not duly provided with mangold wurzel, rye, clover, and perhaps lucern, or other crops applicable to soiling. If he has such crops, vetches are proportionably unnecessary.

IX.—POTATOES.

The following remarks contributed to another publication may be repeated here:—

“The cultivation of this crop increases, notwithstanding the risks to which it is liable. The past autumn (1860), all over the South of England, has been most disastrous for the potato crop; but the great success which has attended its growth elsewhere, is too great an encouragement to proceed with its cultivation to be resisted. The extent of the crop now is probably about 200,000 or more acres in England, 150,000 acres in Scotland, and 1,200,000 acres in Ireland. In Scotland we hear of eight to twelve tons per acre having been obtained, and sold at 5*l.* per ton—the disease having had hardly any influence in the North. In Ireland it was rather more severe than it had latterly been, while all over Southern and Midland England, the season of 1860 was very bad indeed. It has been recommended rather to avoid the application of rich manures, and so to discourage luxuriant growth, under the feeling that the plant was thus made the more liable to disease, and that it was better to have but half a crop of sound potatoes, than to have a heavy bulky crop with the rot in them. The disease is however so far capricious and dependent on the weather, that our recommendation rather is to try for as large a crop as possible; and, using whatever precaution against the disease may lie in your power, to accept the result, whatever it may be, along with a heavy crop, which you are sure to have if you choose a prolific sort, and grow it in a rich soil, liberally manured.”

Early planting, by which you obtain maturity before the time

when the attack of the disease is usually made, is to be recommended. And the last week in March or early in April is as good a time as you can choose. If cultivated and manured in autumn the planting of the sets alone is needed now. Perhaps the best plan would be in that case, simply to plough the land over and plant the sets a foot apart in every third furrow. When the land has been thoroughly tilled and manured before winter, and left in ridgelets twenty-six inches wide, the intervals in these ridgelets may now be horse-hoed, and the sets planted and covered by splitting the ridges with the plough. When the cultivation has been done since winter, you must open up the land as just described in drills about twenty-six inches wide with the double mould-board plough, spread the dung in them, plant the sets on it, and cover up all by splitting these drills again. If potatoes follow a manured green crop, then two cwts. of guano may be sown broadcast over all per acre before covering up the sets—no other manure being used.

Even, however, where farm manure is used abundantly, guano will sometimes prove a profitable addition. The following, for instance, is the account given by Mr. Simpson, of Teavig, Inverness, of his method, which results in good crops :—

“The field on which this experiment was tried is a clay loam, drained and in fair condition. It bore oats in 1857, was ploughed with a deep furrow that autumn, cross-ploughed and broken down in spring 1858, dunged in the drills (twenty-eight inches wide) with twenty loads good farmyard manure per acre, and planted the second week of April with potatoes of the Dalmahoy variety. It did not wholly escape the attack of disease, but, in consequence of the earliness of that variety (it comes in at least three weeks earlier than the Prince Regent, to which in colour, shape, and quality, it bears otherwise a strong resemblance), the tubers were little, if at all affected; not above eight per cent. of the gross produce being diseased. They were lifted the first week of September; and the quantities below are those of sound potatoes gathered and stored, viz. :—

	Tons cwt. lbs.		
Where farmyard alone was used, per imp. acre .	6	5	45
Together with farmyard manure—where sown in the drills (at the cost of 24s. per acre), 1 cwt. Peruvian guano and 3 bushels dissolved bones, per imperial acre	7	9	88
Drills with farmyard manure alone—where top-dressed on June 21st, with 1½ cwt. Peruvian guano (at the cost of 24s. 11d. per acre) . .	7	13	30

Showing in the one case an extra production of 24 cwt. at the cost of 24s.; in the other an extra production of 27 cwt. at the

cost of 24*s.* 11*d.* This is a cheap purchase-money for potatoes, without taking into consideration the benefit the subsequent wheat crop will undoubtedly receive from the remains of the artificial manure stored up for its use in that unfailing bank the soil. Of the certainty of such benefit being derived, we think no one can doubt who has read the very interesting series of experiments as to the effect on the second crop, resulting from the application of guano and other fertilizers, communicated to the Highland and Agricultural Society by Mr. Ferguson, of Coupar Angus, and published (July, 1858) in that Society's Journal. We would remark further in regard to potato planting that we shall in future choose a loamy in preference to a gravelly soil for them. We tried two fields, one clay loam, as described in the above experiment; the other sharp gravel, a first-rate turnip and barley soil, and maiden to potatoes for at least twenty-five years. The crop on the gravel was nearly two tons per acre behind that on the clay-mould field, though in respect to manuring and preparation it was rather the best attended to of the two. We purpose planting our whole crop of Dalmahoy this season in the latter end of March, shall top-dress them with Peruvian guano two cwt. per acre in early May, and anticipate having them sound and safe in their winter pits by the first week of August."

In the choice of a potato there is now ample scope. Next month a plate will be given representing in outline some of the principal sorts; meanwhile it may suffice to name the various round white potatoes called Regents, of which probably by much the largest acreage in potatoes now consists—the Fluke, a large flat kidney recently introduced, and acquiring rapid popularity—the Axbridge kidney potato, of excellent quality, and retaining its quality till late in the year—Stratton's kidney, a prolific and early kind—Soden's early Oxford, &c. Reference will be made to the different kinds in cultivation next month; meanwhile it is necessary that having chosen your kind, in which you will be guided by the experience of your neighbours if your own is not sufficient, and by the prevalent choice in the market, that you should put them into the ground as soon as possible after the middle of March, planting middle-sized whole potatoes as sets, which should have been dried and greened the previous autumn in the sun, kept in pits during winter, moved as soon as the severity of the weather was over, and kept (safe from frost) on floors, not more than two thick if possible, and moved, if necessary, so as to hinder any sprouting, or any breaking of the sprout until they are planted. In sorting sets for planting, it is well rather to choose the larger of the middle size than the smaller, and great crops have been raised when the distance between large sets in well-tilled land has been as much as even two feet from set to set in the row.

The preparation of land for Carrots and Mangold Wurzel occupies attention towards the end of March. The best seedtime for both crops is at the end of April; but if any ploughing needs to be done for either crop, the earlier it is done the better, provided the land be in fit condition for it. The best method of cultivation in the case of both crops is to depend upon autumn tilth and autumn manuring, so that the only thing needed in the case of carrots now is to scarify and harrow the land, and in the case of mangolds to horse-hoe between the ridgelets in which the manure has been lying, and then ridge up again with the double mould-board plough. In either case two or three cwts. per acre of guano and a couple of cwts. of superphosphate—with four cwts. of common salt per acre in addition for mangolds—may be sown broadcast before the cultivation, which will thus mingle it all with the soil.

Land for cabbages treated in autumn as for mangolds may during March and April be scarified and harrowed, and made ready to receive the young plants which will then come early (August) into use. For the main crop a seed bed should have been prepared last month, or may be prepared at once (see p. 108).

For Kohl Rabi land should be now prepared in drills twenty-six inches wide, as for mangolds or potatoes, having a heavy dressing of manure in the drills, and every tenth or twelfth drill in the field being sown now as thick as if with turnip seed, will at the same time provide plants for the whole intervening space, to be transplanted towards the middle of May. A very good account of the crop and its cultivation was given in Vol. XX. of the *English Agricultural Society's Journal*, by Messrs. Lawson, of Edinburgh; and Messrs. Sutton, of Reading, give the following details:—

“The principal sorts are the large green and large purple Kohl Rabi. The cultivation may be described as nearly resembling that of the turnip—the principal difference being in its earlier seed-time. The land receiving as much autumn cultivation as possible, may be ribbed up and well dunged in the drills, the dung being covered by the splitting of these drills before winter. If guano (two or three cwt.) and superphosphate (also two or three cwt. per acre) be spread broadcast over this land in March, and the intervals between the drills be then horse-hoed, and the ridgelets moulded up again by the double mould-board plough, it will then be ready for the seed. Of this, three or four pounds per acre may be drilled in the rows in April or March. The rows in which the dung was placed should be at least two feet apart, and the plants on becoming large enough are to be singled out from twelve to fourteen inches apart. The crop will in favourable seasons, on good adhesive loams, thus richly manured and well cultivated, reach twenty to thirty tons per acre. It is all above the ground, and it is thus ad-

mirably adapted for folding sheep upon it. The seed has hitherto been costly, and therefore it has been more common to grow plants in a seed bed. Half a pound of seed on about two perches of land will furnish ample plants for an acre. The bed is prepared and sowed in March, and the land for the main crop is prepared either in drills as described, or on the flat, the manure being then ploughed in broadcast—and the plants will be ready to transplant in May. If there be a succession of sowings at monthly intervals, as in March, April, May, on successive seed-beds, the plants will be ready for transferring in May, June, and July respectively, and the crop will be ready for consumption in October, and on through winter. The plants may be set out, if on the flat, in rows two feet apart, to allow of the horse-hoe being used between them, and they should be about fifteen to eighteen inches apart in the rows. It is rather more costly to put the crop in by the drilling machine, because so much more seed is used per acre, which is scarce and dear at present. This, however, will no doubt cheapen as the crop comes more largely into use, and the drilling of the crop where it is to grow will probably ultimately be the usual plan of cultivation."

In the first editions of this work the plant was referred to under the name of Reynolds' Cabbage Turnip; and Mr. Reynolds' experience regarding it was thus described by himself:—

"At this time (April 29) there is no less than thirty-five tons per acre. I pitched a fold in the form of an oblong, in two divisions, and placed therein 387 sheep, April 2. The crop has kept them exceeding well, without any fodder, or even any other provision (save only the turning them into a rough pasture a few hours in the middle of the day, for by so doing they return fresh to the roots in the afternoon), and it will maintain them, I am confident, forty days. I placed those designed for fattening in the front, and the store sheep in the rear. The plants are drawn up with a three-pronged hoe. The fold is removed daily, for those in front to have fresh food; and those in the rear eat the remains of what was left the day before. Thus the whole is spent without the least loss, and the land is enriched at the same time. This I say, by experience gained last year, for my barley crop, on land in the same state, turned out very good; both in quantity and quality inferior to none of my other growth (which was upwards of eighty acres); the product full five quarters per acre, sown the 12th of May. Eight milch cows have been fed with these roots for this month past, and are very fond of them; and I have found great saving in my hay since they began them. Both the milk and butter proved very good, and a considerable increase in both kinds. I also found that hogs and pigs like them extremely well. Sows give plenty of milk when fed with these roots. Nothing that I can find out is more beneficial *for spring food*, especially in hard weather. These roots

are proof against frost; whereas turnips have been but of little service in general this spring, the frost having destroyed many of them long ago. But these vegetables are now in a fine flourishing state, quite sound and good; well tasted top and bottom: better food cannot be desired for horned cattle and sheep. This is certain, my sheep are now thriving beyond all expectation."

Mr. Reynolds' experience has been of late years very largely confirmed; but it is doubtful if the Kohl Rabi is likely to come so generally into cultivation, now that the merits of the mangold wurzel as a heavy crop and good spring food are everywhere known.

The land for Turnips I suppose to have been ploughed from stubble at Michaelmas, and cultivated then. In this month it should receive the second earth, that it may, by harrowing well, or by another stirring in April, if the land is stubborn, be made so fine as to ensure the growth of all annual weeds in May. A succeeding ploughing turns them in, and quite destroys them. These "earths," however, are as well or better given them by stirring with the cultivator, than by turning over a furrow slice with the plough so early in the season, especially if the land be at all of an adhesive nature. The various scarifiers and cultivators now made will do their work to any depth the farmer may wish, and this tillage, keeping the surface that has been pulverized by frost unburied, is much more favourable to the growth of weeds than turning it down by ploughing. The work also is done much more rapidly, which, at so busy a season, is an object of great consequence.

X.—HOEING OPERATIONS.

These should be carried on in the fields of young wheat, and also as soon as possible among the early-sown peas, and where parsnips have been sown. An early hoeing is efficient in various ways. It kills the plants more easily than when they have covered the ground, and it does this before any seeds have been ripened, which cannot be said of all hoeings, for those done later in the season often amount to a most efficient seeding of the land for a larger crop of weeds.

Professor Buckman's examination of crop seeds for those of weeds has been already referred to (pp. 128-59). There are many ways by which weeds find their place in our fields; they are directly sown with the crop; they are also distributed by the dung-heaps; they scatter from nurseries by the road-sides; and they are actually sown by the very process of hoeing. The three last methods point to early industry in weed-destruction as our only remedy. Professor Buckman has thus referred to these modes of weed-propagation in the *Agricultural Gazette*:—

The manure heap a nursery for weeds.—All sorts of seeded plants are unhesitatingly mixed with manure, under the impression that as the leaves and stems of weeds decay, so must the seeds also ; but let any one examine the plants that grow on the top of an exposed manure heap, and he will see weeds seeding in sufficient quantity to stock his farm, and if but a few plants seed in this position, how regularly they become sown when the manure is spread. In no other way can we account for the frequent introduction into turnip fields of such plants as *Anthemis*, stinking Chamomile, *Chenopodium*, “Fat hen” of some countries, *Stellaria media*, Chickweed, *Capsella bursa pastoris*, Shepherd’s Purse, and others of a like kind, which are almost wholly confined to manure tillage.

The farmyard is again a source from whence weeds are sent to the muck heap, in refuse from threshing, which is often thrown out under the impression that fowls will eat these useless seeds ; and though it is true that they do in reality destroy some, yet not one-half are picked up by them, and of those that are so, only a small portion becomes destroyed in the process of digestion.

Some few years since we commenced the growth of flax, and our first crop introduced to the field a large crop of *Sinapis nigra*, black mustard, a plant to which it was before a stranger—*Sinapis arvensis*, or charlock, being the previous mustard weed. The seed of this flax was afterwards sown in another part of the farm, thus introducing the black mustard in a new place in an aggravated degree. Afterwards some of the linseed was threshed at the farm buildings, and in various ways its weeds got to a manure heap which was traced to a field of beans of which they were seen to occupy a large strip in the middle, the boundary lines circumscribing the growth of black mustard ; and this is now the general charlock of the farm, it having nearly expelled the former common *Sinapis arvensis*, owing to the greater fecundity of the former—

Sinapis arvensis, charlock, yielding generally 4000 seeds to a plant.

„ *nigra*, black mustard „ 8000 „ „

Waste places weed nurseries.—Fields in their proximity are overrun with their peculiar species in spite of the most careful farming. If we have thistles in a wild hedgerow or neglected corner, we shall never be free from them in our fields. We cannot have coltsfoot or dandelion by the roadside without these weeds causing us the greatest trouble both in adjoining and in far-off fields.

It has more than once been attempted, both for England and Ireland, to get a clause introduced in local acts of Parliament making weeding compulsory in such situations, yet it has remained for our colonists in Melbourne to be the first to make a state law compelling, under penalty, the eradication of thistles.

From the regularity with which weeds are sown from all these sources, it is no wonder that so many men have come to look upon them as a necessity. Let, however, more correct knowledge become general as regards the nature and habits of weeds, and processes of weed destruction be devised in accordance therewith, and we feel quite sure that our enemies will be kept in abeyance.

Early hoeing of weeds is necessary to this end, for that weeds are often multiplied by the very processes employed to get rid of them there can be but little doubt. This may be done, either by subdivision of creeping forms, such as coltsfoot and couch, or by sowing seeded weeds in hoeing. A few seasons back we had a dirty piece of beans containing, amongst other weeds, three circular patches of coltsfoot; this was ploughed and scuffled, and the next summer coltsfoot was tolerably evenly spread over its whole extent. The creeping root of couch is in this way cut into bits by the plough, and though much be picked off the surface, enough of it usually is buried in some instances to increase the evil, and in all to ensure its continuance.

As regards sowing weeds by hoeing, it may be remarked that it is too much the practice to treat all weeds alike, and so attack them all at once in a regulation time of hoeing, and thus as some will be in seed while others are progressing to that point, though we may destroy the latter, yet at the same time we sow the former. It cannot be too strongly urged that as different soils and districts present weeds of different species which do not all arrive at their most mischievous point of growth at the same period, so the only possible way in which to effect the destruction of all is to kill them as soon as they are fully formed, and before they bloom. During March, therefore, the hoe should be at work in dry weather among young wheats. Patches of coltsfoot should be carefully forked out, and no bloom allowed to seed.

XI.—PARING AND BURNING.

This is one of the occasional works of early spring. There is no better way of breaking up old sward, especially on adhesive soils. And even on lighter soils, if there be a large extent of grass land to be converted into arable, it is best, after feeding the grass hard down the previous autumn, to break up at least one-half of it by paring and burning. If one-half be ploughed under before winter, it will yield a large crop of oats, provided it be tolerably free from wireworm; and if the other half be pared and burned, the ashes spread will ensure a capital crop of turnips; and thus at starting you have half corn and half cattle food, and can continue the system you have begun.

The paring (breast ploughing) will cost from 15s. to 20s., accord-

ing to the character of the sward; but it may very well be done, as by Snowdon's paring plough, by horses. The turf is harrowed over roughly, and tiled by hand to dry. Fires are lighted every eight or ten yards, and a heap begun at each, and covered over daily, or rather nightly, as they need. The burning will cost 12s. to 15s. per acre; and the ashes may be spread for 3s. They should be ploughed under with as shallow a furrow as possible, rolled, and after rain, harrowed, and then cross-ploughed at a rather greater depth. The turnip seed being sown in rows upon the flat, will grow luxuriantly with no other manure.

But the burning of the soil of arable land is also carried on in early spring and in the autumn with good effect, especially on calcareous clays. It is adopted for three distinct purposes. It is used for the purpose of destroying an excess of vegetable matter in the soil, being however then confined to comparatively limited districts—those of fens and bogs—and even there it is dying out as its object becomes attained, so that in many districts where the peat was six feet thick, the plough now takes hold of the clayey bed on which it rests. It is adopted, secondly, for the purpose of bringing a turf quickly into tilth, and there its object is not so much to dissipate vegetable matter as merely to destroy its fibrous structure, charring rather than burning being thus the object aimed at. It is employed, thirdly, for the purpose of exposing clays and calcareous soils to just such heat as shall produce certain mechanical and chemical effects that are desired.

The two first objects named are so definite, that it will suffice merely to describe the processes by which they are effected. In the case of peaty soils, a paring plough followed by harrows cuts off a certain layer of the peaty earth, which is then torn to pieces and exposed till dry, and when gathered into heaps and set fire to, will soon leave nothing but its ashes, which are spread at once over the land. Peat ashes are burnt for 2s. to 2s. 4d. per cubic yard. The second case supposed, that of charring turf as a step in the process of converting it to tilth, has been already described. The burning is done in heaps at greater or smaller intervals, according to the anticipated ease or difficulty of the process, a little nucleus of straw being used to every heap, and the heap is laid around so closely as to hinder the process from going on too rapidly. The object should be to obtain black ashes, avoiding that complete dissipation of the vegetable matter which is aimed at in the case of peat.

The most important practice under this head is that, however, of burning clay, and especially I would say calcareous clay, as a piece of periodical management in arable culture. Dr. Voelcker, of Cirencester, who has very carefully investigated the practice of burning clays, attributes its fertilizing influence to the chemical as well as to the mechanical results which it effects; and the failures of the prac-

tice are, in like manner, due to injuries under both of those heads. Clays may be burnt so as very considerably to loosen their texture, render them more friable, and easily reduced to tilth; or they may be burnt till they are literally bricks. They may be burnt till they shall furnish a smaller quantity of soluble matter than they did in their natural state to the influence of the rain; or they may be burnt at a lower temperature, and it will be found that they have thus become capable of yielding to the water passing through them much larger quantities of soluble matter, chiefly alkaline substances, especially useful for root crops, which contain them in large quantity. Probably the best way of burning clays for this purpose is that adopted on the calcareous clays of Gloucestershire, where stifle burning, as it is called, is carried on very generally; chiefly as a preparation for the turnip crop, for which it is especially suited, both on chemical and mechanical grounds, and it is done in the following manner:—The land is ribbed with the plough and worked with the drag to move sufficient earth for burning, and when dug, what rubbish it contains is raked into heaps and set fire to. A few of the large clods being placed round the little heap of burning matter, and smaller clods around them, until at length the fine earth is placed over all, and the heaps being watched, more earth is shovelled on wherever the fire appears to be coming through. A skilful workman is thus able by means of a very small quantity of vegetable matter in the middle to char a very considerable quantity of earth, which thus becomes a very valuable dressing for the land.

The following letter, from a Cotswold farmer, describes the process:—

“Stifle burning obtains much in this neighbourhood, chiefly for the production of turnips; the process is this:—Generally after a corn crop, or a new or old clover lea, the land is ploughed thin, and after sufficient harrowing and rolling to reduce the clods to a moderate size, the light weedy part is raked into small heaps, at proper distances; the loose surface clod and earth is then pushed with the inverted rake in a ring round the bottom of each heap, which is then lighted with a wisp of straw before placed in the heap. After a little time all the cloddy ring of earth is spread evenly over the fire, with an iron or light wooden shovel, and made firm, which stifles the smoke, and diffuses the heat through the whole mass, requiring only a little proper attention to reduce nearly all the heap to ashes. In a few days, when required, the ashes are evenly spread and ploughed in. The heaping, burning, and spreading the ashes are generally done by the piece, costing about 12s. per acre; and it usually takes besides, about eighteen cwt. of wheat straw or stubble per acre. The quantity of ashes it is difficult to estimate; but, in an instance known to me, in which a neighbour stifle-burned a clover lea from which a crop of hay was just cleared, and it had been

then ploughed thin, on carefully measuring the ashes the average quantity per acre was 4200 bushels; the land was rather a heavy, dead loam, with marl subsoil. The result was a fine crop of turnips, and good corn following; and at the end of the course, when turnips again, the part of the field thus burnt had better roots than the other part. We find the general result of stifle-burning alone, or as an auxiliary to farm-yard or artificial manure, to be the production of good root crops, leaving the land in a clean, friable state for corn, and improved condition for young seeds. One objection to stifle burning is that, requiring fine, dry, warm weather for the process, the hands may be otherwise employed at other important work, according to the period of the year."

It is, however, a common practice in many clay districts to burn large quantities of clay in heaps by means of faggots, or even coal, and apply the ashes to the land. Mr. Beaumont describes his practice on a farm of Lord Mansfield, which was a poor clay, at a rent reduced by the poverty and consequent incapacity of its tenants to 10s. per acre when he took it in hand, and his first step was to burn enormous quantities of this clay soil. He tells us that in 1853 he put 10,000 cubic yards on 100 acres of land with an extraordinary result. His straw was quadrupled in bulk, and the grain doubled in value; an excellent turnip crop was attained. A large herd of cattle was kept during the winter in the fold-yard, and a famous heap of manure resulted for use in the following spring. After another year's experience, during which nearly as much burnt earth again has been put on, the valuation for grain crops has been again raised from 700*l.* to 1200*l.*, and the stock of cattle has been increased. Mr. Beaumont put the cost of the process at 6*d.* per cubic yard of the clay measured after burning; filling, spreading, and applying 2*d.*; fuel, &c., 1*d.*; so that 4*l.* per acre covered the cost of putting on 100 cubic yards.

Mr. Pusey gives us his experience on clay land in Berkshire. He put on eighty yards of burnt clay per acre previous to sowing wheat, and found that it raised the produce from thirty-seven bushels to forty-five bushels per acre.

Mr. Francis Page, of Baldock, on a heavy clay land farm in Cambridgeshire, burns all the borders and headlands of his fields with the help of turf and faggots during summer-fallow time, burning very slowly in heaps of from fifty to one hundred yards each, at the cost of 6*d.* or 7*d.* per yard; and by applying forty or fifty yards per acre he has raised the average of his wheat crop from twenty-five to thirty-five bushels per acre.

In Essex the practice of burning is more generally confined to the clods of the surface, which are gathered together in heaps at intervals of eight or twelve yards apart, and burnt with stubble, a waggon-load per acre being used for this purpose at a cost of 25*s.*

per acre, somewhat after the fashion of stifle-burning, and repeated every four or six years with excellent effect, both on straw crops and on green crops.

But perhaps the most remarkable instance of the improvement of cold and heavy soils by burning is that on Chadbury Farm, Evesham, in Gloucestershire, where Mr. Randall has, at a cost of from 2*l.* to 4*l.* per acre, put on one hundred cubic yards of burnt clay, raising his produce so that in some instances the wheat crop was worth more than the fee simple of the land in its former state.

These instances, then, may suffice to prove that on the stiff clay soils of some English districts the practice of burning has been attended with remarkable fertilizing influence; the soil is found to work more easily, and the plants of grain crops and of green crops grow more luxuriantly and yield more abundantly.

Dung heaps should now be turned and commingled. Those intended for the fields where carrots are to be sown should be the first. This operation will cost 1*d.* per cubic yard, measured *before* turning. Six inches of the soil on which the heap lies should be thrown up with it. Dung heaps, too, will still be forming in fields for turnips, &c., being carried out from the yards whenever time and weather permit. And among other occasional employment during March, there will be the threshing of grain for the market, or for the supply of straw, and the completion of all work connected with fences and roads. Stones should be picked off any fields, whether in grass or corn, over which either scythe or reaping machine is to go this year. In this work, no stones are to be taken but such as would impede the scythe. It has been often remarked, that too much stone picking has done a very sensible mischief. Mr. Macro, of Suffolk, ascertained it experimentally. "Having often thought that picking the stones off my turnip lands did more hurt than good, I tried an experiment last spring by gathering up all the stones of one square rod, after the turnips were folded off, and laying them equally over another square rod by the side of it, then sowed them with barley, and marked them out, and at harvest time collected them separately, as likewise another square rod by the side of them, which had only the natural quantity of stones.

	Qrts. Pints.			Qrs. B. P.		
Produce from the rod that had the double quantity of stones	6	1	{ or, per acre,	4	0	2
Ditto from that where the stones were gathered off				3	6	0
Ditto, from that in its natural state ...				3	7	1"

Hop-garden.—Throwing and sorting hop-poles is concluded this month. Young hops may be planted, the ground for which, where not trenched, had been previously subsoiled; and then holes, about twenty inches square, are dug for the reception of the plants.

The hop-grounds are now becoming quite animated from the number of men employed in digging, as a preparation for the cutting or pruning process, which is usually performed during the month of March. This process consists in cutting off the shoots which sprung from the crown of the plant last spring, and were afterwards tied to the poles. The crown of the plant is thus left about nine inches below the surface, standing, as it were, in a small basin, and is pruned into a convex shape. The clearing away of the earth is done by men, and the shoots are cut off with sharp knives by women.

The poling commences towards the end of this month. The hop-poles vary from ten to twenty feet in length; and each hop-hill is provided with two, three, or four, according to circumstances. It is impossible to lay down any precise rule either as regards the number or length of poles required; both depend upon the quality of the soil, and variety of the hop. This part of the cultivation, in fact, demands the exercise of a good deal of experienced skill, if properly done. Besides the above work, labourers are employed in bedding out cuttings to form plants for the next year.

XII.—THE LIVE STOCK.

Horses are to receive during March their full allowance of food. Two bushels of oats and half a bushel of beans per week, together with hay, probably one and a half cwts. per week, or mixed chaff of hay and oat straw. An allowance of carrots, about thirty lbs. daily, is also a wholesome provender. Their labour during March and April is as heavy as at any time of the year, and they should be fed accordingly.

Feeding Cattle are sold as they fatten and become ready for the market. The treatment of the previous months is continued, becoming if anything more liberal of rich food as the animal ripens for the butcher.

Breeding Cattle now occupy the attention of the farmer; more calves drop in March than in any other month. We abstract a very instructive paper, by a "Practical Farmer," on the cow at calving time from the *Mark Lane Express* :—

"As the time of calving approaches (which every breeder may ascertain by recording the date of bulling, and counting on about forty or forty-one weeks, or 280 days, as the period of gestation), she should be separated from the herd—in cold weather to a warm, clean, and well-ventilated hovel, or barn, where she should be constantly watched, and well but not profusely fed. As 'labour' comes on, she should not be disturbed, but for a time left to her own natural efforts. When in the judgment of the herdsman the calf is sufficiently advanced to be felt, he should gently insert his hand in the uterus, to ascertain that the presentation is right, *i.e.*,

that the two fore feet and the nose of the calf can be felt; if so, she may be left a reasonable time to deliver herself, but he may occasionally assist a little. Should the labour be somewhat protracted, he must then summon assistance, and take the calf away, otherwise the strong continuous paining of the cow will frequently kill the calf ere it is born. The common course pursued in taking away a calf is to cause the cow to stand up, and then to draw a little forward the feet, and fasten around the legs and above the first joints a cord of sufficient strength and such pliability as not to bruise the legs. The hand or fingers should then be inserted, so as to place the head or nose right, *i.e.*, just upon, or rather slightly between the legs. The assistants may then gently draw the legs forward, bearing the cord downwards; the herdsman meanwhile endeavouring to push gently back any portion of the uterus brought prominent by the head, and aid by gentle means as he best can the delivery. As soon as the calf is brought forth its nostrils should be immediately cleansed from adhering mucus, the mouth opened, and when it has breathed freely it may be rubbed carefully with a wisp and then presented to the mother, who will at once lick it freely with her tongue, which acts as both brush and currycomb most advantageously. In a few minutes it should be lifted up, supported, and enticed to suck. If it sucks freely, very little danger is to be apprehended, and the dam and calf may be safely left together. Warm water should be given to the cow, and her food should be of a mild and nutritious character, avoiding cold roots or the like. The calf should be left with the dam at least three days, in order that it may draw its food at first naturally, and as it requires it. By this time the first milk or biestings, acting as a gentle purge, will have passed through its bowels, cleansing them of all mucus; it may then be safely removed to the calf-house to be brought up by hand if required. In cases of wrong presentation it is best to send for the veterinary surgeon.

“The discharge of the afterbirth is not of any great moment. Generally, this ‘cleansing’ comes away, without much effort on the part of the cow, in a few hours. It may be left to its natural chance for several days.

“When the cow has had a protracted and difficult calving time, she will require careful treatment. In common natural cases she will soon be all right; but in difficult cases brushing of the belly and loins with a wisp is serviceable—gentle walking exercise for a short time in fine weather is useful. Gruels and cordial drinks should also occasionally be given. The latter might consist of a quart of ale mixed with sugar or treacle, and diluted with water, to be given warm. She must have her warm water mixed with a little meal, as above stated. Should fever intervene, it is best to send for the veterinary surgeon, and commit the case to his care.

"Cows after calving should be carefully fed with nutritious food, in small quantities often repeated; and it is certainly best to give cooked or boiled food, as it prevents more generally indigestion and flatulent colic. At all events, sweet and easily digested food should be given, or material injury may arise. Should the udder swell from excess of milk, or the incapacity of the calf to draw it all away, frequent milking is requisite, and it should be hand-rubbed well, with frequent washings of warm water and soft soap, or with warm bran water. The teats occasionally become sore: the same applications should be resorted to, and, in addition, a little lard, olive oil, or even cream, should be gently rubbed on, particularly in cases of pustules arising, or scab."

Fatting Sheep in fold or yard continue to receive the treatment already described. They may now be shorn as they become fat, and they are thus sold naked to the butcher.

The Ewe flock needs constant care this month, which is in most districts the chief lambing season. We again quote from the "Practical Farmer":—

"It is requisite to provide suitable lambing paddocks or pens for the lambing season, to which the ewes can be taken every night. In them, and also about the pasture field, or adjoining fields, shelter pens should be constructed, into which a ewe about to lamb, or immediately after she has lambed, should be put, if the weather is unfavourable. These pens are made with straw-wattled hurdles; five hurdles making a double pen, three being set down parallel with each other, and so near that the two other hurdles form the back and front. As the season draws nigh every preparation is made, and the allowance of food is increased. The ewes being heavy with lamb, require additional support. When their "time is up," my ewes are constantly watched for a few days upon the pastures where they have been wintered. As soon as the lambs begin to fall, they are collected into a roomy field, provided as above, in the corner of which, adjoining the shepherd's house, are the lambing paddocks, into which they are driven every dark and unfavourable night. In fine open moonlight nights they are sometimes left out, as it is desirable that the paddocks or lambing pens should be freed from taint, *i.e.*, be sweetened occasionally. Tainted straw or gangrenous droppings are sometimes fatal to ewes if they come in contact with the wounded uterus. On the large farms upon the Downs and Wolds, and in many other parts of the country, ewes are generally, if not universally, lambed while on turnips. In such cases lambing yards, or pens of sufficient capacity, should be provided, with a temporary house for the shepherd. It is constant and untiring attention that is required. It is only in special cases that the shepherd's skill and experience are brought into requisition.

"The ewe about to lamb must be examined by the shepherd to

ascertain that all is right. This being found correct (*i.e.*, the nose and fore-feet in front, and ready to come forth), she should be left awhile to her own efforts. Should her pains be protracted, the shepherd must lend assistance, or the lamb will be dead ere it is brought forth. The ewe should be gently laid upon her side: the shepherd should then draw one foot forward after the other, and then by a steady pull draw the lamb away. If the lamb is wrongly presented, then comes the difficulty and danger: the shepherd has to push it back most frequently into the lamb-pouch, there turn it, and by the ewe's pains, and his guidance and help, it is often brought away without much damage. The ewe, in all cases of severe labour, should have a small tablespoonful of laudanum administered, to keep her from paining till the parts become easier, followed in a day or two by a small dose of Epsom salts, and warm cordial drinks or gruel, and suitable food, such as hay, chaff, and sliced turnips or carrots.

"*The lamb* should be cleared of all adhesion around the nostrils as soon as it is born, and very soon afterwards suckled. The ewe's udder should be cleared of wool, to prevent its being drawn in by the lamb. The castration should take place about fourteen days after birth, on a mild, damp morning. As the ewes lamb they should be drafted off to other pastures, and the lambs ought there to have access to a fenced enclosure, where they can enjoy a ration of corn and cake to themselves."

Fattening lambs with their mothers are still folded in the turnip field, receiving cut turnips, or cut mangolds or carrots in troughs (see p. 53), and they should have also as much pease and oilcake as they will eat. Some of the forward ones dropped at Christmas time are now ready for the butcher, and generally make a profitable return for their keep.

Lammermoor Farm.—The following is the report for March from the moorland farm already named (page 112):—

"Cheviot ewes are now getting turnips when there is abundance of them. Some are netted close on; others during a part of the day, having a run off during the night; while others have some carted out to their grazing-ground, at the rate of a cart-load to 130 sheep. A few of the leanest of the black-faces are already on turnips, and some more of them will be put on next week. This treatment will be continued till the lambing begins, which will be in about five weeks. Besides the immediate benefit which the sheep derive from the turnips, the pastures will be cleaned and freshened when they return to them, and better enable them to maintain the improved condition they have received from the turnips.

"Spring has hardly yet affected any of the common grasses, except the Moss or Hair's-tail cotton Grass, the earliest and hardiest

of our hill plants, which begins to put out its flower-stems with the first fresh weather in February. It grows most abundantly on spongy, peaty soil. Wherever this valuable plant abounds, sheep not only thrive better, but grow more wool, than those in pastures where it is wanting, even though they get turnips during the spring months. Shepherds are hired at this time for another year. The following are common wages for the district: Thirty ewes, ten ewe hoggs, a cow's keep; sixty-four stones (imp.) of oatmeal, six bushels of barley, and 57s. in lieu of potatoes. The shepherd manufactures his own peats and hay, the master carting them home; he also furnishes a worker for six weeks as house-rent, or keeps a worker from Whitsunday to Martinmas, at 10*d.* per day.

Swine receive the same treatment as already specified in previous months. March is a good month on dairy farms for the farrowing of the sow, as the waste of the dairy becomes more plentiful, and there is no better provision or assistance for the young pigs than whey and butter-milk. The treatment of fattening hogs has been already described.

Poultry will now require constant attention. It is useful to keep Cochins, to give a supply of eggs through the winter, and to be ready when the Dorkings or other kinds lay eggs for them to sit on. The Cochins are the best layers in winter, and the best sitters and nurses to rear the young ones. The Dorkings and the Game Fowls are perhaps the best for hardy farm-yard rearing. A good food for chickens, the first week or two after hatching, is grated bread with broken hard-boiled eggs. Feed often with this; also cut up all the scraps of meat, fat, potatoes, and bread, left at dinner, in very fine bits and give a good meal of this mixture daily; gradually give refuse small grain, wheat or hempseed, and potatoes and dry meal ("thirds" or sharps) mixed, as the young ones grow larger. Keep the coops very clean, and place clean water always near them. A Rouen drake and Aylesbury ducks supply the best eggs for young ducks for feeding purposes. The young ones are best reared by a hen. They should be fed on meal in a paste, given frequently; and as they grow older, some raw liver, mixed with the meal, is good for them once a day.

Turkeys require great care in rearing. Grated bread and hard-boiled eggs, with a little curd from the dairy, with chives or young onions chopped fine, is the best food at first. Porridge of oatmeal, with bread, milk, and boiled nettles, make a good change of diet for young turkeys; give also grain of any sort, as they can take it. Let them have a wide range over fields, if convenient, when they are quite strong to follow the mother.

The best kind of geese for a farm are the large White or Embden Geese. They attain a great weight. They need access to a pond; and if the young are left entirely to the mother's care, on a

grass plot, or in a field, and let go to their own house at night, they can be reared quite as successfully, even from hatching time, as if cooped and more tenderly fed.

XIII.—THE DAIRY.

The following paragraph is from the pen of a Gloucestershire dairywoman, and was published in the *Agricultural Gazette* of 1856:—

The general operations of the dairy in the month of March must of course materially depend upon the time of the coming in of the cows, which, however, usually commences in this month. A great proportion of the milk is required the first fortnight as food for the calves, even if they are not intended to be fattened. If they are, of course it must be continued till they are sold to the butcher.

Cheese-making.—The milk thus early in the season is not considered of importance as regards cheese-making, as if new milk be used for that purpose, it causes fermentation, and this renders the cheese of very inferior quality, and often of very little value; therefore the appropriation of the milk to the purpose of butter-making is much the most advantageous use to be made of it. Independently of the inferior quality of the cheese that is made from the early milk, another objection to using it is the uncertainty of the quantity brought into the dairy after the calves have had their portion, which renders the supply too irregular for making cheese with advantage. On every account, therefore, it is considered most desirable to use the milk entirely for butter. Sometimes when the dairy is very early, persons are induced to begin cheese-making towards the end of this month, but in that case only for family purposes, when at least half the cream is taken from it, and even then it is very subject to heave. To prevent this many plans have been adopted; one of simple character has, however, been tried with much success. After the rennet is put into the milk, add a little of the sour whey which is going to be taken from the dairy, about a pint to forty or fifty gallons will be sufficient.

Butter-making.—The new milk after the cows have calved should not be brought into the dairy to be set up for butter under three days; if not all taken by the calves it is useless excepting for the pigs; after the third day it may be set up to produce cream, and it has been found, that by skimming the milk every twelve hours the flavour of the butter is better than when it is left on the milk twenty-four hours, which is a plan many persons adopt, with the idea that they obtain a greater proportion of butter from one thick than from two thin skimmings. If the milk should yield a trifle more in quantity, which is doubtful, the difference is not equal to the improved quality of the butter if the cream has not been

allowed to remain on the milk more than twelve hours; this experiment has been tried on succeeding weeks, when the butter has proved decidedly better by the mode of management here recommended. The cream should be kept in tin vessels suited to the convenience of changing it, which should be done every day, and a flat piece of wood or slice should be kept in the tins, which the dairymaid should use whenever she has an opportunity by stirring it frequently; this prevents a skin from rising, which is a disadvantage to the butter. The cream should be churned twice a-week; when the butter is taken from the churn, a clean cloth that has been scalded and afterwards left to lie in cold water should be used to beat it with; this will absorb all the buttermilk if wrung dry and the beating repeated three or four times; after this a quantity, according to taste, of fine salt should be added, and worked in with the hands, when it will be ready for making up into any form required, without the use of water. The process of washing it is by some persons thought quite necessary for making good butter, and it is said that the milk cannot be properly extracted from it without using a quantity of water; but if the experiment be tried after the mode of making above recommended, it will be found that no butter-milk whatever remains in it. It has been ascertained, from many years' experience, that butter made without the application of water retains its sweetness a longer time than when water is used, and it does not appear at all unreasonable that this should be the case, when we recollect that the washing of meat prevents its keeping as long as it would do if no water were applied to it. Some persons have an objection to salt, and there is a method of making butter without it, by keeping the small pats or prints, as they are sometimes called, in strong salt and water after they are made; the butter is very delicate thus prepared, but is never sold in the market, and can only be procured by bespeaking it at a dairy.

Weaning calves.—When calves are intended for weaning, which is usually done this month, or as early as convenient in the season, they should be selected from the best and oldest cows, experience proving to the farmer that a heifer's first and second calf are not so strong and likely to thrive well as those from cows of tried constitution. See pages 47 and 111. Much patience and care is required by the attendant to induce them to drink well without sucking it from the fingers, and great loss is often occasioned by neglect, and letting them remain to be driven by hunger to take the milk. The stomach of a calf being very delicate, it is most easily affected by any change, and scouring soon follows a little fasting aggravated by the irritation and fear of losing its mother, which often retards the growth of young calves for several weeks, if it does not cost their lives. A little patient teaching, and the observation of their natural habits and instincts are quite necessary

in those having the charge of young animals, which of course need to be taught a process even of feeding when it is unnatural to them. When they can drink well, one quart of best or new milk will be sufficient, added to which they should get half a pint of good oatmeal; or the same quantity of linseed has been found equally nourishing and sufficient to keep them in good growing condition. Both the meal and linseed may be prepared in the same way, viz., thus, take for each calf half a pint of oatmeal or linseed, mix it in a little cold water, and then add sufficient quite boiling to make the allowance for each calf two quarts of liquid; keep it in a covered vessel till required to be given. The morning's meal should be prepared the night before, as it should stand for some hours, and that given at night should be made in the morning, and if made in large quantities it retains some heat; a little more boiling water may be added to give it the warmth of new milk, one quart of which should be given with two quarts of this liquid to each calf.

The milking cows should now get the best food provided for them, with access to good water; the comfort of shelter, and everything tending to secure their good condition, surely tending to greater produce of milk. Roots and good hay can generally be supplied on every farm, and any disagreeable taste in the butter from the food of the cattle can be prevented by putting about a dessert spoonful of saltpetre, finely powdered, to about three quarts of the cream immediately it is taken off the milk, placing it in a tin vessel to stand in boiling water, and constantly stirring the cream while it is heating and until it cools again; about half an hour is sufficient for the whole process. About a teaspoonful of common salt, and half the quantity of saltpetre have proved also of use in preventing any disagreeable flavour in butter occasioned by the food of the cattle, being put into the proportion of two gallons of milk, when it is brought in warm from the cow and placed in pans, or any vessel provided to receive it, to stand in till the cream is skimmed from it.

XIV.—FARM ACCOUNTS.

This subject will engage our attention at Michaelmas, which is more generally the time for closing the books for the year, as it is also more generally the time of entry to a farm. It may, however, be well at once to call attention to the importance of keeping a good labour book, both as distributing among the accounts to which it all belongs the sum paid during the year as wages on the farm, and as incidentally supplying a list of dates of the several operations performed during the year, to which instructive reference may be often made when an explanation is desired of results observed in the field. Account-keeping is of course based upon an exact record kept of payments and receipts. From the day-book in which

these are day by day recorded, the items are transferred to the accounts in the ledger to which they severally belong; and on comparing the total receipts and payments under each at the close of the year, it will be found what profit or loss has occurred under each; the payment columns including the valuation under each head of stock or cultivation to which the tenant enters, as by payment, at the beginning of the year; and the columns of receipts, including the similar valuation of stock and cultivation at the close of the year, of which sale is, as it were, made to the tenant (yourself or another) during the ensuing year. But of wages, which are paid in so many different small sums, it is difficult to make the same allotment of your payments to the accounts indebted by them, as where actual and definite purchases or sales are made. And a good labour-book is therefore a necessary part of any good system of farm book-keeping. The following is a description of our labour-book, which we have used for many years:—Every folio (*i.e.*, the double page seen on opening the book) contains, beginning from your left, successive columns—1. for the weekly wage given to each; 2. for the name of the labourer—man, woman, or child; 3. six small columns (in which a single letter, *a*, *b*, or *c* may be written) for the days of the week; 4. a succession of money columns, *a*, *b*, *c*, &c., as many as may be needed, there being one for every account opened in the ledger; 5. a money column headed as “total;” and 6. a column for “observations.” If payment be made fortnightly, instead of six daily columns (under 3) there should be twelve for the days of the fortnight; but otherwise the book is drawn up the same. Every evening, in the column (3) of the day you enter the letters *a*, *b*, *c*, &c., of the account for which each labourer has been working, and if he has been working half a day apiece for any two, an entry of the two letters proper for them may easily be made. On pay-day you can see how many days each labourer has been working during the week or fortnight since last pay; and after payment, your daily record enables you to distribute among the columns of the several accounts the wages you have paid to each man, woman, or child, in the proportion in which these accounts have been severally indebted. And on adding up these money columns you learn the sums to be placed among the payments under the several accounts in the day-book for that week’s or fortnight’s wages. Such a labour-book greatly facilitates the work of keeping accurate accounts. A more detailed reference to this subject, with descriptions of the other books concerned, will be given in September.

XV.—LADY-DAY ENTRIES.

In the case of spring entry to a farm, the outgoing tenant usually reaps the crops he has sown, giving up to his successor only

the land in clover and grass, and the fallow land to be prepared for green crops. The outgoing tenant retains the corn-growing part of the farm; and reaps, threshes, and sells the crop he has sown. The valuation between him and his successor includes whatever stock and implements it may be mutually agreed upon to leave—together with whatever cultivation has been done on last year's stubble for the fallow crops of the coming year, and the seed and labour connected with the young grasses and clover given up, as well as whatever the custom of the country allows for straw and manure upon the farm. The turnips and other green crops of last year's growth have been fed upon the land during the winter, and those fields have been already sown with barley, or oats, or spring wheat by the outgoing tenant, who will reap the advantage of the sheepfold on the crops he reaps.

But sometimes one tenant succeeds another at this season of the year, taking entirely to his whole interest in the land; and when the custom of the country requires payment for straw and manure, nearly the whole of the incoming tenant's capital will thus be at once invested in a single payment, according to the valuation between him and his predecessor.

Such a valuation will include—(1) working cattle, harness, and implements; (2) live stock—cattle, sheep, and swine; (3) the labour and cultivation of fallows, and the same with the seed of growing corn and clover; (4) such a portion of the labour, and cultivation, and manure of the fallow and green crop of the previous year as may be supposed to be still in the soil for the benefit of the young grain crop; (5) the unconsumed portion of the outgoing tenant's roots and straw; and (6) any grain still unthreshed in rick or barn.

It is plain if this last item be in sufficient quantity to pay for the labour up till the autumn, and for the first half-year's rent then due, that the valuation on entry will in the case of a fully-stocked farm at once take up all the capital needed for the proper working of the farm.

Such a case is, however, very rare; and Lady-day entries are generally confined to cases in which the outgoing tenant disposes of all his interest in the farm in the usual way, leaving for valuation only those items of which the custom of the country forbids his removal from the land, or for which it gives him a claim upon his successor.

APRIL.

The ordinary weather of April will be gathered from the meteorological table on next page, compiled by Mr. Lowe, of Nottinghamshire, in which the temperature and rainfall for a number of years at different stations in England are specified.

The ordinary operations of the farm during April direct attention to the subjects of (1) *crop rotations*; (2) *steam cultivation*; (3) *grass seeds and sowing*; (4) *grain crops*, the sowing of the latest sown, and the cultivation of the earliest sown among them; (5) *flax culture*. (6) *Green crop cultivation*, more especially that of carrots and mangold wurzel, will engage attention, and potato planting should be finished; (7) *Lucerne*, vetches, and sainfoin may be sown; (8) the *live stock* of the farm of course continue to occupy attention.

I.—CROP ROTATIONS.

Our List of Crops.—Perhaps the first consideration which strikes one, on a survey of this question, is the fact that notwithstanding the large number of plants which are the subjects of British agriculture, there is room given in our ordinary rotations for the cultivation of so very few. Probably there is no single rotation of crops which rules so large an extent of land in this country as the Norfolk or four-course system. It prevails all over the southern, the eastern, and the midland counties of England. 1, wheat; 2, turnips; 3, barley; 4, clover and grass seeds:—These are the four plants and crops to which almost exclusively, I may say, generations of farmers over a very large proportion of England have confined their attention. Nothing of course can be simpler than the management of a farm on such a plan. Even when conducted on the most liberal and energetic system nothing can be simpler.

Now, just contrast such a practice with the fact that we have in our libraries a large volume entirely taken up with short descriptions of the plants that English farmers may cultivate. Mr. Lawson's *Agriculturist's Manual* indicates that there is a very large scope indeed given to the farmer in the selection of his crops, and the list of wheat, barley, turnips, clover, in which alone many a large farmer in the south and east of England is interested, widens out into a catalogue of many pages length. Messrs. Lawson arrange the plants of English agriculture under five classes:—

- I. Plants cultivated for their farinaceous seeds;
- II. Those cultivated for their herbage and forage;
- III. Those cultivated for their roots;

THE WEATHER OF APRIL.

Locality.	Authority.	Mean temperature.	Lowest mean temperature.	Highest mean temperature.	Greatest heat.	Lowest maximum heat.	Highest minimum cold.	Greatest cold.	Average amount of rain, inches.	Smallest amount of rain, inches.	Greatest amount of rain, inches.	Average number of rainy days.	Smallest number of rainy days.	Greatest number of rainy days.	No. of years' observations.
Guernsey.....	Dr. Hoskins, F.R.S.	46.6	42.7	48.4	69.5	54.0	42.5	34.0	2.4	0.2	4.4	13	5	21	12
Helston	Mr. M. P. Moyle ..	48.1	47.5	53.1	75.0	60.0	35.0	29.0	2.8	0.6	4.7	11	3	20	16
Exeter	Mr. W. H. Ellis.....	47.8	44.1	51.2	72.9	63.0	34.2	25.0	2.8	0.2	6.0	16	6	24	13
Ventnor, I. of Wight	Dr. Martin	49.0	45.3	53.2	75.0	58.0	40.0	30.0	1.7	0.1	3.7	12	1	20	22
Worthing, Sussex	Dr. Barker	45.6	43.8	48.4	64.4	55.0	34.8	30.0	1.9	0.1	3.5	11	2	18	8
Clifton, near Bristol	Mr. W. Burder, FRAS	45.5	42.5	48.6	73.5	60.9	30.7	24.2	2.2	0.1	3.1	13	2	17	8
London Royal Observatory	{ The Astronomer } { Royal, F.R.S. }	45.7	38.7	51.7	79.0	57.0	38.0	25.3	1.8	0.1	3.4	13	2	23	90
Oxford Observatory	Rev. R. Main, F.R.S.	45.6	41.5	48.9	74.5	63.0	32.7	25.0	1.8	0.4	3.6	12	3	20	33
Bedford	Dr. Barker	46.4	43.3	50.1	82.0	67.0	31.5	23.5	1.5	0.3	3.3	11	3	19	10
Lampeter, near {	Rev. Prof. Matthews,	44.5	42.5	46.5	75.4	64.0	30.0	21.8	3.4	0.8	4.6	14	11	18	6
Cardigan	M. A.	44.7	42.3	47.6	76.0	61.0	32.0	21.0	1.8	0.2	3.9	12	3	22	20
Norwich	Mr. W. Brooke, FRAS	47.3	42.3	51.1	79.0	62.5	36.0	21.0	1.8	0.5	4.3	16	4	23	51*
Highfield-House } Observatory .. }	Mr. E. J. Lowe, F.R.A.S.	45.1	42.0	46.4	76.9	63.3	33.2	26.1	1.5	0.2	3.2	11	4	18	10
Grantham	Mr. J. Jeans, F.R.A.S.	44.8	41.3	47.6	75.5	60.0	34.5	25.0	1.8	0.4	3.6	10	4	18	9
Hawarden, Chester	Dr. Moffat, F.R.A.S.	46.6	44.4	49.4	79.0	64.0	29.7	22.8	1.8	0.5	3.1	13	3	22	11
Manchester	Mr. G. Vernon FRAS	46.6	43.0	51.0	89.0	63.0	32.0	24.0	1.6	0.1	4.0	14	5	23	10
Leeds	Mr. H. Denny	45.1	42.4	49.7	73.0	61.0	32.0	23.0	1.6	0.2	4.2	12	2	20	20
York	Mr. Ford	42.5	40.6	44.0	70.0	56.5	34.6	27.3	1.9	0.3	5.3	9	2	15	6
Scarborough	Mr. B. Cooke	43.7	42.0	47.2	70.1	56.6	34.7	26.8	2.3	0.5	4.4	11	8	16	7
Isle of Man	Mr. J. Burman, FRAS	41.7	40.5	43.1	71.5	60.1	30.6	26.3	1.7	0.5	2.5	12	7	15	5
Durham Observry	Mr. A. Marth, FRAS	44.2	41.0	47.2	71.8	54.8	35.7	25.0	1.9	0.3	6.3	17	7	25	15
North Shields	Mr. R. Spencer	45.6	42.7	50.2	72.9	61.6	31.5	21.0	1.8	0.7	3.7	10	2	14	7
Silloth	Rev. F. Redford														

* Observations at Highfield House on temperature extend over fifty years, and at the Royal Observatory over ninety years.

IV. Plants cultivated for their uses in domestic economy and the arts; and

V. Those cultivated for their timber.

The first class consists of two divisions, viz., cereal grains and leguminous plants, besides buckwheat and some few other things which belong to neither.

The second includes gramineous and leguminous and cruciferous herbage and forage plants.

The third includes tuberous-rooted plants and fleshy-rooted plants.

The fourth class contains plants yielding fibre, oil, dyes respectively, besides certain other principles and extracts of use in certain manufactures.

The fifth class includes the whole subject of arboriculture.

Our cereal grains include wheat, barley, oats, rye, canary grass. Our leguminous grains include beans, peas, and vetches. The agricultural grasses are a class of at least ten or twelve desirable plants; our leguminous forage plants include clover, vetches, sainfoin, Lucerne, gorse; and our cruciferous forage plants include the cabbage, mustard, rape. The potato is almost the only valuable tuberous-rooted plant we grow, but plants with thick fleshy "roots" include the turnip, mangold wurzel, carrot, and parsnip. And the fourth class of plants yielding fibre, oil, dye, &c., include flax, hemp, rape, mustard, madder, teazel, hop, and others. The fifth class need not be here referred to, because timber-bearing plants are not the subject of ordinary farm management, although on the great scale their natural history does illustrate the theory of crop rotations.

Here, then, is a multitude of plants, in the presence of which our four, five, and six years' courses of cropping certainly seem ludicrously disproportioned. It is, however, the fact, that notwithstanding the number of plants that have been named, there are only a few of them which occupy large tracts of land in this country. The returns for 1854 of the agricultural statistics of eleven counties in England enabled an estimate of the cropping of all the arable land of the country; and in accordance with that estimate it appears that of the 152 plots of 100,000 acres each, of which English arable land consists, 38 are in wheat, 26 are in barley, 13 are in oats, 7 are in beans or peas, 23 are in turnips, 2 are in potatoes, 2 are in vetches, $1\frac{3}{4}$ are in mangold wurzel, $\frac{3}{4}$ are in rye, 28 are in clover and grass, and 9 are in bare fallow, while there is not half a one in flax, hemp, and hops together, nor one in all other crops put together. This shows that though our ordinary rotations give scope for but few of our cultivated plants, yet these few do really supply the main wants of the country.

The same is true of Scottish agriculture; for in 1856, of thirty-

five such plots of 100,000 acres each, $2\frac{1}{2}$ were in wheat, $1\frac{1}{2}$ in barley, 9 in oats, $\frac{1}{2}$ in beans and peas, $4\frac{1}{4}$ in turnips, $1\frac{1}{2}$ in potatoes, $14\frac{3}{4}$ in grass, and not one-half in all the other crops put together. The inference is, that a very simple rotation does after all meet all the demands which on the whole are made upon English and Scottish agriculture. And the fact is, that it has not been out of the demands of commerce that any deviation has been made in practice from our ordinary simple four, or five, or six field rotations. It has been out of the difficulties which the soil itself and the experience of its cultivators have presented in the way of so frequent a recurrence of the same crop on the same land.

And this brings us to the second point to which the attention of the student of this subject is naturally directed. The first probably is the comparatively large scope which English agriculture possesses, and the limited use that our crop rotations make of it. The next expresses itself in the question—Whence the need of such crops as are cultivated succeeding one another?

The Succession of Crops.—If clay land be best for wheat and beans, and moist sandy land be fit for oats, and gravelly soil for barley—if turnip soils are for the most part a tolerably distinct class—why not devote land permanently to the growth of the crop for which it is thus the best adapted—growing wheat and beans permanently on stiff soils, barley and turnips on light soils, and so on. Whence the need of taking the several crops one after another?

In the first place every farmer must grow a number of crops whether he has a variety of soil upon his farm or not, (*a*) because the relation in which he stands to his labourers requires that a pretty even quantity of employment be provided all the year through. If one or two crops only be cultivated this will not be the case—the labour will be accumulated at one or two parts of the year, and so men will either be idle during long intervals or will at any rate be unable to find constant employment on the same farm, which it is for the interest of all parties they should.

Then again (*b*) not only must we grow a number of crops on account of our labourers, but we must grow a number on each farm because of our live stock—not only are employment and wages wanted every month in the year, but food for cattle is wanted every month in the year, and for this reason, therefore, as a general rule, a variety of crops is needed on the farm.

But why must these crops be taken after one another? To this question there are several answers. Thus, first, any one plant when grown successively and repeatedly on the same plot of ground does under ordinary circumstances and according to ordinary experience degenerate and dwindle. The wheat plant will, if it come to a ripe maturity at all, do so in a stunted form; but it will probably, more or less, die before it arrives at maturity, and I have seen as the

result obviously of this one cause many acres unhealthily white long before harvest time. The turnip will, even if taken so seldom as once in every four years, in the course of time no longer bear so quick a succession, and it acquires a diseased and stunted and forked growth. The clover plant is another illustration of the same truth—the so-called clover sickness being consequent upon the frequent recurrence of the clover crop upon the ground. The improvement of grass lands with their age, though an apparent, is not a real exception to the rule of these instances. Different species and even different classes of plants grow *together* on the same land there, and so one at any rate of the conditions provided by a rotation of crops, viz., the demand upon the soil being varied by the cultivation of a variety of crops, is secured.

But besides plants degenerating as a general rule if taken repeatedly from the same ground, it is found that crops succeed better when taken in a certain order after one another. Thus wheat grows better after beans than after oats or barley, and a succession in which grain crops and green crops alternate is found in general practice more productive than one in which grain crops follow one another. This experience of the productiveness of the crops we cultivate is one of the reasons for a *rotation* in the place of a *succession* of crops. The explanation of this experience is a point on which the attention of scientific men has been more bestowed, probably, than on any other point in the whole range of farm practice. There are three principal theories which are each of them founded more or less fairly on observed facts, by which the need of a rotation of crops is explained.

(1) There is the theory founded on the fact that plants during growth excrete certain juices from their roots which are thus returned to the soil. De Candolle entertained the idea that a crop might render the land on which it grew unsuitable to itself by overloading it with this excreted matter, and that though the soil was thus rendered unsuitable for the crop in question, yet it was not in this way unfitted for the growth of any other. The excrementitious matter of one plant might indeed be real nutriment to another, and thus was explained not only how wheat after wheat would not prosper, but also how wheat succeeded better after beans than after some other crops, as oats, or barley, or even turnips or potatoes. This theory, though consistent with the actual experience of the farmer, has fallen into disrepute. It is now believed that the organic juices excreted by the growing plant cannot remain unaltered through months of exposure in a soil to be in force when the young plant again comes to be drawing its nourishment from the soil in question.

(2) There is the theory of exhaustion. It is known that the mineral part of a plant does not correspond in composition with

that of the mineral matter in solution within a soil, and by repeating the plant therefore on the same land it is obvious that certain ingredients in the soil will be exhausted sooner than others—faster, indeed, than the natural process of disintegration will supply them from the more permanent part of the soil. Wheat taken repeatedly from the land, straw and all, would rob it rapidly of its soluble silica; turnips would rob it rapidly of its potash. But if these crops be taken in succession the soil will have a longer time in which to accumulate and present for use the necessary ingredients when the crop requiring them as food shall come round again. It certainly is the case that some plants, such as wheat, oats, and barley, are characterized by the large quantity of soluble silica which they remove from the land; and others, such as peas and tares, by the considerable quantity of lime; and others, such as turnips and mangolds, by the large quantity of potash they remove; and so in contradistinction to the excretory theory which accounts for failure on the ground of the presence of poisonous substances, the theory of exhaustion is stated as follows:—

“In so far as chemical principles are concerned, the true *general* reason why a second or third crop of the same kind will not grow well is—not that the soil contains too much of any, but that it contains too little of one or more kinds of matter. If after a skilful manuring turnips grow luxuriantly, it is because the soil has been enriched with all that that crop requires. If a healthy barley crop follow the turnips it is because the soil still contains all the food of this new plant. If clover thrive after this it is because it actually requires certain kinds of nourishment which neither of the former crops has exhausted. If again luxuriant wheat succeeds it is because the soil abounds still in all that the wheat crop needs—the failing vegetable and other matters of the surface being increased and renewed by the decaying roots of the preceding crop of clover. And if now turnips refuse to give again a fair return it is because you have not added to the soil a fresh supply of that manure without which they cannot thrive. Add the manure and the same rotation of crops may again ensue.”

This is the theory by which exhaustion is made the explanation of crop rotation. And it does receive some countenance from the researches of the chemist into the composition of plants. And if the composition of our ordinary crops per acre, so far as mineral ingredients are concerned, does not fully tally with this theory, the turnip and mangold crop, which are restorative crops in practice, being under this theory in reality more exhaustive of the land than a wheat crop or a barley crop, which are in practice the exhaustive crops *par excellence*, yet it must be remembered that these green crops are not sold off the land in ordinary farm practice, and that the straw of our corn crops and the hay of our grass crops are also

returned to the land through the means of the animals fed upon them.

(3) Nevertheless the theory now most generally held is a different one yet. In the first the soil is supposed to require a succession of crops because each poisons the ground for itself; in the second because each exhausts the ground for itself; and in the third because in the system under which green crops alternate with grain crops, the former by their consumption on the land accumulate there the nitrogenous matter which by the manner of their growth they have absorbed from the air.

This theory supposes that "the beneficial effects of rotation, in increasing the production of saleable produce (so far as they are chemical), are not explained by the fact of one plant taking from the soil more of the different mineral constituents than another, but depend on the property of the so-called green or fallow crops of bringing, or conserving, upon the farm more substances rich in nitrogen than is yielded to them in manure; whilst the crops to which they are subservient are both largely exported from the farm, and yield in their increase considerably less nitrogen than is given to them in manure."

This last is the theory to which Mr. Lawes' researches have led him.

It modifies the theory of exhaustion, and renders it perfectly consistent with the facts of every farmer's experience.

It is the prevalent opinion that rotations have a *necessary* relation to fertility: thus, certain rules on the subject are made imperative in most leases. It is well known, however, that rotations have no necessary relation to fertility at all, for there is many a worked-out farm cultivated by a man who keeps to the letter of his lease; and all, therefore, that can be said for a rotation is, that a man bound to it cannot rob his land so rapidly as he could by repeating the same crops year after year. Fertility can be ensured, and will be ensured, wherever intelligent men see it to be their interest to grow large crops. It can be done, even though they are hampered by being bound down to certain rotations; but, in such cases, rotations are generally a hindrance instead of an advantage. Farmers, however, sometimes act under the influence, not of their interest in the long run, but of their immediate necessities. A rotation, unadvisable if the cultivation could be ensured as being always in the hands of a wealthy and intelligent tenantry, may thus be properly insisted on. Let us, however, confine ourselves at present to a discussion of one or two of the more common rotations of cropping adopted in this country. Among them is the Norfolk, or four course—1, wheat; 2, turnips; 3, barley; 4, clover.

It is adapted especially for a light soil. It is prevalent in the east and south of England, and in many of the midland counties. The

whole of a recent discussion on rotation of crops before the London Farmers' Club hinged on the faults of this one system, as if almost no other were in existence; and if any further proof of its general adoption were wanted, we may mention that the agricultural statistics of Norfolk, 1854, put the crops thus:—Wheat, 200,000 acres; barley, 174,000; turnips and mangold wurzel, 180,000; clover, 172,000. In Hampshire, again, wheat was 59,000 acres; barley and oats, 64,000; turnips, 50,000; clover, 52,000; thus proving the almost universality of this quartering of the arable land among these four crops.

Its faults are many:—Turnips ultimately fail, become diseased, attacked by finger-and-toe, and so on, if taken so often from the land. And if they succeed, then the practice of folding sheep upon them induces such an extremely luxuriant growth in the succeeding crop of barley, that in good turnip years a good *malting* sample of barley is impossible. And lastly, clover cannot be had once in four years: the clover sickness seems to be an unavoidable thing under these circumstances.

Whatever be the liberality of the treatment, indeed, under the four-course system of cropping, we have continual failures both in the turnip and in the clover crop. The remedies are to lay only half the barley down with clover seed, and plough the stubble of the other half up for winter beans, taking wheat after beans on that half, and thus converting the four fields into eight, which will then be cropped in succession, thus:—1, wheat; 2, turnips; 3, barley; 4, clover; 5, wheat; 6, turnips; 7, barley or wheat; 8, beans.

It is, however, found that by feeding upon the land the large bulk of food for sheep which is provided by the Norfolk rotation, the barley is too strawy, and is often laid, and produces a coarse sample; and the further alteration of the rotation, which departs still more widely from the principle of the four-field system, is to take wheat or oats first after roots, and follow that by barley, to be followed by clover and beans or wheat. You thus get a heavy crop of oats or wheat, and the barley still finds enough to live upon in the land, and is a much better sample. Of course, the modification of the altered rotation by substituting mangold wurzel for one of the crops of turnips will very generally obtain in England; thus further altering the four-field into an eight-field course of cropping, or when the Norfolk system is made a five-field course, making it a nine years' course of cropping.

The modification of the Norfolk course of cropping by taking a crop of wheat or oats between the turnips and the barley, possible and even justifiable and desirable under a liberal course of management, is paraphrased in the north of England by another modification better adapted to what may be called the self-supporting system of agriculture. In Northumberland the Norfolk course becomes a

five years' series by allowing the grass seeds to remain down two years. In East Lothian, again, a six years' course of crops is prevalent:—1, wheat; 2, turnips; 3, wheat or barley; 4, grass; 5, oats; 6, beans or potatoes. But this is greatly modified on farms where potatoe culture is the most important because the most profitable part of farm management; potatoes are there taken after turnips and followed by wheat, beans, wheat, grass, and oats; thus converting the course into one of seven years' duration. The four years' course of Norfolk, with its modifications, and the six years' course of East Lothian, with *its* modifications, seem to be the two distinctive rotations of the country. But the varieties are endless.

In Gloucestershire, on the Cotswold district, wheat is often followed by oats, that by turnips, and these by barley and seeds. In the Fen districts of Lincolnshire oats are followed by wheat, and that by grass seeds and clover, to be broken up for wheat and followed by beans, after which another crop of wheat is taken and followed by rape or coleseed, thus making seven years' rotation.

I have not mentioned the word "bare fallow" yet in the course of these rotations, but if you go upon the clay lands of the country you will find them still frequently subject to this management. A bare fallow is the commencement of a course of cropping just as under better management a fallow crop is the first of the series. The rotations of the country are well discussed and fully enumerated in Mr. Caird's "English Agriculture," and among those prevalent on the clay lands of the country he specifies that of Essex—1, fallow; 2, wheat; 3, beans; 4, wheat; 5, mangolds; 6, barley; 7, clover; 8, wheat.

The following, again, is the rotation on the alluvial or "carse" clays of Scotland—1, fallow; 2, wheat; 3, barley; 4, clover; 5, oats; 6, beans; 7, wheat. In this case the second succession corn crop, barley after wheat, receives a short preparative fallow in March and April before being sown, and the clover seed is always a better plant after barley and on a recently stirred soil than after winter wheat. A heavy application of dung is spread over the oat stubble, which is left to be washed into the ground by the autumnal and winter rains, and the land is found to turn up very mellow and rich in January and February, when, after being some time exposed to the action of the frost, it is sown with beans. The beans are generally, with this preparation, a heavy crop, and leave the land in a good state for wheat or oats.

There are, indeed, numberless methods of taking crops in succession, but in place of any detailed description of them we will add a mere enumeration of some of those which have obtained an extensive adoption.—

	1.	2.	3.	4.	5.	6.
1	Wheat	Wheat	Wheat	Wheat	Wheat	Wheat
2	Turnips	Turnips and Mangld Wurzel	Turnips	Turnips	Turnips	Beans
3	Barley	Barley and Wheat	Wheat	Barley	Barley	Wheat
4	Clover	Clover and Beans	Barley	Grass	Grass	Clover
5	...	...	Clover	Grass	Oats	Wheat
6	...	...	...	...	Potatoes and Beans	Swedes and Carrots
7	...	...	...	...	...	Wheat
8	...	...	...	...	...	Mangld Wurzel

	7.	8.	9.	10.	11.	12.
1	Wheat	Fallow	Fallow	Wheat	Wheat	Turnips
2	Oats	Wheat	Wheat	Turnip	Rye & Grass*	Potatoes
3	Turnips	Beans	Barley	Potatoes	Barley	Wheat
4	Barley	Wheat	Clover	Wheat	Clover	Clover
5	Clover	Swedes and Mangold	Oats	Grass	Oats	Oats
6	...	Barley	Beans	Oats	Beans and Turnips	...
7	...	Clover	Wheat	Beans	...	...
8	...	Wheat	...	...	...	...

- No. 1. The Norfolk rotation.
 „ 2. Do., as sometimes modified.
 „ 3. Ditto ditto.
 „ 4. Northumberland course.
 „ 5. East Lothian ditto
 „ 6. Whitfield farm.

- No. 7. Cotswold district.
 „ 8. Essex clay soil.
 „ 9. Scottish Carse lands.
 „ 10. East Lothian (Potato culture).
 „ 11. Mr. Hewitt Davis (for light soils).
 „ 12. Mr. Caird's recommendation.

II.—STEAM CULTIVATION.

It is well during this, one of the busiest months of the year, when horse labour is harder than at almost any other time, to call attention to that substitute for horses in the field, which is to benefit the farmer not more by a direct annual saving of expenditure in the stable, than by greater efficiency in the cultivation of the soil. For the clay land farmer especially, the benefit under both of these heads by substituting steam power for horse labour in the fields is enormous. He, much more than the light land cultivator, needs to keep a large team of horses throughout the year for the sake of their work during three or four months; and he, too, more than the other, will benefit by that completer tillage which steam power can effect. On our stiffest clays on many farms six

* Followed by cabbages and turnips.

horses per 100 acres are no uncommon allowance, while on lighter soils one-half that number will suffice. And on such heavy soils the trampling of the team beneath the furrow slice produces a hardened floor which necessarily interferes with fertility, confining the soil indeed to a mere shallow layer of tilled earth, instead of permitting the roots of plants freely to expatiate throughout that greater depth from which nourishment will be drawn as soon as by a steam-drawn implement, involving no pressure on the subsoil, that floor shall have been thoroughly broken up.

I propose in one of the autumn months to describe in detail the various methods of steam culture which have been adopted; meanwhile it may suffice to name as the two chief ones that of Fowler, and that of Smith, of Woolstone. In the former, the engine travels along one headland, and a self-worked anchor travels opposite to it along the other: a wire rope, passing round a single pulley beneath the engine and around a pulley in the anchor, is drawn to and fro—a half circuit at a time—thus causing an implement, either a so-called balance plough, or a grubber, to travel strip by strip over the whole surface between the two headlands. The plough turns over three or four furrows each journey, and the grubber works four to six feet of width at a time, and so from five to eight acres are done each day. In the latter method—that of Mr. Smith, of Woolstone—a fixed engine works a fixed double windlass, and the wire rope goes all round the field, or rather around that part of it not yet worked, and the anchorages carrying pulleys are shifted step by step by hand, as it may be necessary, to allow the grubber worked to and fro between them gradually to encroach upon and overtake the portion of the field yet untilled. Drawings will hereafter be given of the two systems, and of the various improvements which have at length made Fowler's apparatus a perfect arrangement for the economical application of steam power to a draught implement of tillage. But I will give here, abridged from an account which I have already elsewhere* published, the history of Fowler's and of Smith's of Woolstone's system respectively on one or two large farms.

1. Fowler's Plough on Peasemore Farm, near Newbury, Berkshire.—Peasemore Farm forms part of an open country, well timbered here and there around the villages, but otherwise bare, and being high, somewhat cold and bleak. The fields are unfenced except against the roads. It is upwards of 770 acres in extent, of which about 30 are in permanent pasture. The soil is for the most part on a clayey drift, with which the chalk is here overspread. It is accordingly of a much stiffer character than any one seeing the chalk-pits open here and there in the neighbourhood would expect

* *The Agricultural Gazette.*

to find it. So stiff, indeed, that by a single ploughing in the wet you may easily destroy your chance for the whole season of reducing it to tilth.

Mr. Plummer, who succeeded the late Mr. Tull, and has been resident at Peasemore for rather more than a year, introduced Mr. Fowler's 12-horse power steam plough about thirteen months ago. He has in consequence already reduced the former horse-power of the farm (rather more than thirty horses) to six three-horse teams, and an odd horse for the water-cart, and ultimately he expects to dispense with another team, reducing his number of draught animals to fifteen or sixteen.

Let us see what he saves by this: In the first place, comparing nineteen with thirty-one, he avoids the purchase of twelve horses, at an expense probably (at 35*l.*, or thereabouts, a-piece) of 420*l.* The annual expense of these animals, as employed upon the farm, is difficult to estimate; it is made up of food, maintenance at original value, smith work, harness, and farriery, maintenance of the implements worked by them, and wages. The *food* of these horses is stated to me to have been two bushels of oats a-piece weekly throughout the year, and half a bushel of beans in addition during three months of seed-time. They have hay *ad lib.* during the winter months, and cut green food—trifolium, clover, vetches, &c., during summer. The oats and beans may be valued at 2*s.* 6*d.* and 4*s.* 6*d.* a bushel consumed at home—the hay at 3*s.* a cwt., and the green food cut and brought home at 6*d.* per cwt.

(a) The following, then, will be the annual cost of food—

	£	s.	d.
Oats, 104 bushels, at 2 <i>s.</i> 6 <i>d.</i>	13	0	0
Beans, 6 bushels, at 4 <i>s.</i> 6 <i>d.</i>	1	7	0
Hay, 22 weeks, 1½ cwt. a week, at 3 <i>s.</i> per cwt.	4	19	0
Green food, 30 weeks, 7 cwt. a week, at 6 <i>d.</i> per cwt.	5	5	0
	24	11	0

(b) To this must be added the annual cost of smith's work, carpenter's work,* and saddlery, and farriery, probably 2 9 0

(c) And the annual depreciation of value, at least 10 per cent., on 35*l.* 3 0 0

30 0 0

The annual cost under these heads amounts to 30*l.*, and this over 12 horses is 360 0 0

(d) To this must be added the wages paid, viz., head carter, at 13*s.*, and probably 3 younger men at 9*s.*, 40*s.*† weekly, or per annum 104 0 0

* Implements of carriage will remain as many as ever on the farm. Implements of tillage will be diminished in larger number than in the proportion of the horses displaced. The carpenter's bill upon the latter will remain in full, but a more than average smith's bill, so far as the implements are concerned, will be saved.

† The whole expense is probably 20*s.* weekly more for four carter's boys—but this has not been taken into account; for the steam plough has not in effect dis-

Brought forward . . . £464 0 0

(e) The annual cost of the implements required for any number of horses may be put at 2s. per acre on the land which they would cultivate, supposing them to be the whole horse-power employed on a given extent of land. But as in this case they are displaced only so far as cultivation is concerned, and, indeed, only a certain department of that, this item is necessarily much smaller. The quantity of carriage, of harrowing, and rolling, and sowing for the whole farm remains as it was, and the same number of the implements for these purposes will be in use. On the other hand, the ploughs and scarifiers will be reduced in number more than in proportion to the teams displaced, and probably the implements displaced may cost as much as 150% ; and 10 per cent. on the whole for depreciation, will be . . . 15 0 0

We thus arrive at a total annual saving of . . . 479 0 0

(f) To this should be added 5 per cent. on the money invested in the horses and their implements (probably 570%.) or . . . 28 10 0

Making a total of about . . . £507 10 0

This is the annual cost which has been displaced by Mr. Plummer's steam plough. Let us now inquire his expenditure upon the substitute. He has spent on the engine and machinery 780%. His annual expenditure in repairs, fuel, oil, and depreciation of value is not easily ascertained, and it is proper to add here that some of the items have been incurred in working for a neighbour. I therefore make a proportionate deduction from their amount whenever justifiable, guided by the fact that of 878 acres actually worked within the year, only 700 acres have been done on the farm, so as to displace the twelve horses whose cost has just been calculated.

(a) Mr. Plummer has purchased this spring 400 yards of new wire rope, and it appears from as detailed an examination as I could give, that this is likely to be an annual purchase, and that the old rope will require annual replacement to this extent in order to preserve its efficiency.

The annual cost under the head of rope will therefore be about £ s. d.
60%, or, deducting 12% for work done off the farm . . . 48 0 0

(b) Repairs of anchor and engine and plough. I examined Mr. Plummer's accounts from March to December, and the amount in the past year under this head seems to have been 50% 16s. 3d. This includes everything needed connected with every part of the machinery, and is otherwise excessive, so that I shall not be wrong in putting the probable sum hereafter chargeable under this head at not more per annum than . . . 30 0 0

(c) The consumption of coals is of course a costly item. They are 18s. a ton at Newbury, eight miles off. The quantity consumed was about 56 tons per annum, costing . . . 51 0 0

Carriage of 56 tons from Newbury, being in otherwise empty return waggon, say . . . 9 0 0

Annual cost of coals, 1860—61 . . . 60 0 0

placed farm labour, and probably quite as much as 20s. weekly is paid, besides the wages of the steam ploughmen, in addition to the remaining hands formerly employed.

Brought forward	£60 0 0
I find that during the year about 700 acres have been ploughed or scarified on Peasemore by this consumption of fuel, and this amounts to rather more than $1\frac{1}{2}$ cwt. of coal per acre, or including carriage, about 2s. per acre. Mr. Plummer has however ploughed 180 acres for a neighbour, but the coal used in that case was supplied to him.	
Of the oil consumed during the year I have no record, but it may probably be put as high as a gallon every four days, or on the whole 25 or 30 gallons for the work upon the farm	6 0 0

The coals and oil together cost then about	66 0 0
(d) The depreciation in the value of the engine, though nothing perhaps during the first year of its use, must of course amount to a considerable item in the long run, and probably it may be fair to charge 10 per cent. on the value of the whole apparatus, excluding the rope, which is supposed to be kept good by the purchase annually of 400 yards. This item, therefore, amounts to	68 0 0

(e) To this must be added the wages of the men employed, who are farm-labourers, engaged in other farm work when not at work with the steam plough. The daily wage when thus at work, is as follows:—Driver, 3s.; ploughman, 3s.; anchor lad, 2s.; three boys, at 11d.; water-cart boy and horse, estimated at 3s. 3d.; or in all, 14s. Now, during the past year they ploughed and scarified 878 acres, of which about 180 acres were off the farm; and, though I have no exact record of the days when they were at work, yet the 700 acres ploughed at Peasemore can hardly have been done in less time than 110 days, including stoppages, removals, &c.; 110 days, at 14s.	77 0 0
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(f) The removals, referred to, take less than four hours each, and may be taken to require the assistance, upon the average, of four horses with a man each time. Supposing one removal for every twenty-five acres, we have to charge against the steam plough twenty-eight removals, of half a day each of one man and four horses; fourteen days, at 15s.	10 10 0
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To recapitulate, then:—we have as the annual cost of work at Peasemore done by steam power:—

	£	s.	d.
Rope	48	0	0
Repairs	30	0	0
Coals	60	0	0
Oil	6	0	0
Depreciation of value	68	0	0
Wages, including supply of water	77	0	0
Removals	10	10	0
	299	10	0
And 5 per cent. on the cost of the whole apparatus	39	0	0
Amounting to a total annual cost of	£338	10	0

Horse and steam power, then, may be thus contrasted, so far as the cost incurred on Peasemore during the year 1860-61 is concerned:—

Cost incurred by

	Twelve horses.	Share* of engine.
5 per cent. on 1st cost ...	£28 10 0	£39 0 0
Food—fuel, &c. ...	294 12 0	66 0 0
Bills—repairs ...	44 8 0	78 0 0
Depreciation ...	36 0 0	68 0 0
Wages ...	104 0 0	87 10 0
	£507 10 0	£338 10 0

If the whole cost to Mr. Plummer of the engine for the year be added up, not deducting tear and wear upon a neighbour's farm, and adding for other costs and wages, then the amount is 389*l*.

But there has been received for 120 acres of ploughing at 10*s*., and for 60 acres at 12*s*. for the work done upon that farm, or 96*l*. in all, so that the sum actually spent by Mr. Plummer during the year on his steam plough has been only 242*l*., as against 507*l*. saved. And if it be urged that there will be in general work enough upon the farm for the engine and its machinery without going out for hire, then the cost of 389*l*. which would have been charged against it on Peasemore Farm alone must be compared with the larger sum which the horse labour displaced would have cost—for in that case Mr. Plummer expects to do with one team less—to save five teams instead of four—*i.e.*, to save 600*l*. instead of 500*l*. per annum.

Besides which, it must be remembered that the year 1860-61 has been one of the worst years for the tillage of the land, whatever power may have been adopted, that has been known.

It results, then, upon the whole, from Mr. Plummer's experience during this year—taking no account of his work except upon his own farm—that 700 acres ploughing and scarifying cost 1*s*. 10*d*. an acre for fuel and oil, 2*s*. 3*d*. an acre for repairs of all kinds, 2*s*. 6*d*. an acre for wages, including share of removals, and about 3*s*. 1*d*. an acre for interest and depreciation of value. These sums amount to 9*s*. 8*d*. per acre, or 338*l*. 13*s*. 4*d*. on the 700 acres cultivated by steam; the actual cost as already estimated being 338*l*. 10*s*.

In connexion with this estimated cost per acre of steam ploughing, there is this to be borne in mind—that Mr. Plummer's neighbours gladly hire his men and apparatus at 12*s*. an acre, paying for the coals (2*s*. an acre) themselves; and, above all, that the

* "Share" of engine—this assumes that every year as large a portion of the cost of the engine will be chargeable for work done off the farm on hire.

depth and quality of the work thus done are an immense enhancement of the mere immediate advantage on a money valuation which Mr. Plummer thus derives.

The difference between the ploughing by horse-power and by steam, though obvious enough, is greater in reality than it appears. It is the disturbance and breaking up of the old floor beneath the shallow soil on which the horses employed in its cultivation have been for centuries treading, that is the great advantage of the steam drawn plough; and this, though ultimately discovered in the greater luxuriance of the subsequent vegetable growth, is not immediately seen. But a thorough ploughing by steam-power in good season is generally visible enough in the better tilth which is almost immediately observable. I walked across one field after it had been ploughed by steam this spring (1861). This steam cultivation crossed the cultivation of the previous autumn, which had been partly done by steam and partly by horse-power, and the difference was very greatly in favour of the previous steam ploughing.

In another field, again, (33 acres), which had been in 1860 in barley, oats, and wheat (11 acres each), one end was then in spring vetches, looking as well and promising as possible—the middle piece after oats had just been sown with rape. They were horse-ploughing it as I walked over it, and the harrows were following almost close behind the plough. A particular line across the field divided the tilth from the clods; on one side it was breaking down before the harrows as well as possible; on the other side the land was clung, and rough, and intractable. That line separated the 22 acres which had been steam-ploughed in March, 1860, for barley and oats, and which had been again steam-ploughed in October, 1860, from the 11 acres of wheat stubble which had been horse-ploughed for turnips. But it is not in mere instances of this kind alone that the advantage of steam-culture lies. The result will appear at length not only in a more complete utilization of the natural fertility of the soil and in a consequent and constant annual increase of crops, but in a quickened and more energetic character impressed alike upon both labourers and employers.

2. Mr. Smith's Grubber, at Sutton Courtney, near Abingdon.—On Mr. Pullen's farm, which lies between this long and straggling village and the Didcot Station on the Great Western Railway, Smith's steam cultivator has been employed since August, 1858. The apparatus was purchased at the Chester Meeting of the Royal Agricultural Society, and was soon (August, 1858) at work on peas and bean stubble for wheat sowing; and since that time 1480 acres have been cultivated by it.

The farm is 700 acres in extent, of which 600 acres are arable. It lies for the most part over gravel upon the Oxford clay. At least 500 acres are thus a tolerably open soil, the remainder is, how-

ever, upon the sheer clay, and some of it is thus "the stiffest land in England." It is very flat, and lying low, was last year (1860) flooded over a considerable part of its surface. It is in several ways particularly well adapted for steam cultivation. Thus it is open and unfenced except against the drift ways and roads; it is sufficiently heavy to make horse labour always costly and often mischievous, and in particular there is not a field or division of it which has not water close at hand in ditches through it or around it. Instead, therefore, of a horse and cart, a boy and bucket are all that is needed for the water supply of the engine, and even that is sometimes dispensed with, the engine pumping directly from the ditch by which it stands.

The rotation adopted on this farm, while it is especially adapted to the stiffer class of soils, is framed with a particular view to the provision of food for a large quantity of fattening stock. There is no bare fallow; and excepting here and there a field for mangold wurzel, as well as the case of wheat stubble ploughed for spring corn, there is not even any winter fallow. The following is the ordinary cropping of the land. Of 600 acres, 200 are in wheat; 150 in barley; 100 acres are first trefoil or vetches, and then Swedish and common turnips or rape, a field or two lying fallow during winter for mangold wurzel; 100 acres are beans and peas; and 50 acres are in broad clover.

Of the wheat stubble half comes up for barley and half for vetches, &c., and roots. Of the barley stubble 50 acres are in clover, and 100 are for beans and peas. Half the root crop, all the beans and peas stubble, and the clover, are followed by wheat.

It is in the laborious rather than the exhausting character of the rotation that we are especially interested. There are only 50 acres of broad clover on the whole 600 acres; 550 then are every year in cultivation. Wheat stubbles need autumn and spring ploughing for barley, and autumn ploughing for vetches, &c., and again more than one ploughing for turnips. Barley stubbles (excepting 50 acres sown with clover) need autumn cultivation for beans and peas. Beans and peas stubble needs ploughing for wheat. The fields in root crops, carted off or fed upon the land, need ploughing for barley or for wheat. The clover needs also ploughing up for wheat. It is not too much to say that every year upon 600 acres there are at least 900 acres of ploughing, besides other cultivation, needed. The number of horses kept upon the farm was accordingly unusually large.

Ten three-horse teams were needed for its cultivation; occasionally, on the lighter lands, worked in pairs. The steam grubber has displaced twelve, so that the stock which Mr. Pullen now finds enough is eighteen. The twelve horses displaced would have done in their proportion 360 acres of the ploughing which we have esti-

mated to be needed annually under the rotation, besides their share of all the other work. I found that the steam cultivator had given a grubbing (once) to 1480 acres since August, 1858. There were still about 80 acres of vetches and trefoil to prepare for turnips and rape this season; if for these we put down 160 acres of grubbing yet to be done, then probably the three years' cultivation will reach 1640 acres, or about 550 annually, equal at the average rate of performance to 110 days' work each year.

The following is the estimated cost to Mr. Pullen of the displaced horses:—

	£	s.	d.
<i>Food</i> .—Two bushels of oats weekly during half the year, and one bushel weekly during the other half:—			
78 bushels, at 2s. 6d.	9	15	0
Hay, 1 cwt. weekly, 39 weeks, at 3s.	5	17	0
Cut forage for two months, 1 cwt. daily, at 6d.	1	10	0
Pasturage, 18 weeks at 4s.	3	12	0
	20	14	0
<i>Extras</i> , including farriery, harness, smith-work	2	6	0
Maintenance of value, 10 per cent.	2	10	0
	22	30	0
The whole annual cost is thus	£25	10	0
And this over twelve horses, amounts to	£306	0	0
The cost of <i>repairs and maintenance</i> of the implements worked by these and other horses which have been displaced by the steam cultivator, may be	18	0	0
The <i>wages</i> saved by displacing twelve horses may be:—One carter, 12s., three ploughmen, at 9s., four boys, at 3s. 6d. Some of these are still retained, and I therefore suppose the amount actually saved to be 40s. weekly, or in all	104	0	0
Lastly, there is interest of money, or 5 per cent. on 300 <i>l.</i> , the value of the horses, or in all	15	0	0
The sum thus annually saved is thus	£443	0	0

We now come to consider the cost of the steam-power substituted; and let us take the actual history of the first two years of Mr. Pullen's experience.

His apparatus, including windlass, rope, anchorage, rope pulleys, and cultivators, cost 210*l.* He bought a second-hand 7-horse-power engine for 150*l.*, and at the end of two years, after 5*l.* of repairs upon it, he sold it for 130*l.* He has since bought an 8-horse-power double-cylinder engine from Roby, of Lincoln, with Williams' self-driving apparatus—costing in all 300*l.* His good fortune with his first engine is no doubt an exceptional case, but what we have to do with as historians is that it is an actual one. His rope, costing 50*l.* was worn out at the end of two years, and another costing 51*l.* was substituted. His windlass has cost nothing as yet for repairs since he had it, and it seems in good condition now. The repairs on the

other parts of the tackle and on the cultivator have not exceeded 10*l.* during the two years, and three dozen shares have been bought during the period, costing 3*l.*

	£	s.	d.
The cost of <i>repairs</i> per annum, including new rope, adding up the items specified and dividing by 2, amounts to	44	0	0
The <i>fuel</i> has averaged 10 cwt. a day, costing on the ground, 10 <i>s.</i> , and this, on 110 days, amounts to	55	0	0
The oil used is half a gallon a week; or	2	10	0
The <i>wages</i> are as follows:—Engine-man, 2 <i>s.</i> 6 <i>d.</i> ; two anchor-men, at 2 <i>s.</i> ; two men with grubber, at 2 <i>s.</i> ; a boy at windlass, 6 <i>d.</i> ; and boy to carry water, 1 <i>s.</i> ; 12 <i>s.</i> a day, or	66	0	0
To this must be added the cost of removals—viz., 2 hours each time of eight horses (viz. three or four to engine, two or three to windlass, and two to waggon holding tools), and two extra men—probably thirty removals, equal to 6 or 7 days of all this labour, at 24 <i>s.</i>	8	0	0
The whole thus amounts to	74	0	0
The <i>maintenance of the apparatus</i> I put down at 10 per cent. upon 210 <i>l.</i> its cost	21	0	0
The maintenance of the engine is, of course, in this case not incurred, as it was sold, and the loss has been already specified under the head of repairs			
The interest of money invested in the apparatus and engine, 360 <i>l.</i> at 5 per cent., is	18	0	0
The whole annual cost amounts to	£214	10	0

Supposing the cultivation to amount, as I have calculated it, to 550 acres annually—then it has during the first two years cost Mr. Pullen about 7*s.* 9*d.* an acre, being as nearly as possible 2*s.* an acre for coals and oil, as nearly as possible 3*s.* for repairs and maintenance of apparatus and interest of capital, and 2*s.* 9*d.* an acre for wages.

This is what I estimate the cost of the work during the first two years. The items in the future will be somewhat different.

	£	s.	d.
Let us suppose the repairs to be the same, or excluding loss upon the engine	34	0	0
Wages (with less laborious removals)	68	0	0
10 per cent. on 510 <i>l.</i>	51	0	0
Fuel, 6 or 7 cwt. a day, 110 days, probably	40	0	0
Interest of money, 510 <i>l.</i>	25	10	0
In all	£218	10	0

This is nearly the same as it has been hitherto; but Mr. Pullen reaps an advantage by the purchase of his better engine—(1) because ten per cent. for maintenance, though I have adopted it, is practically an excessive charge—(2) because no doubt the more powerful engine will raise the average performance beyond five acres

a day—and (3) because of the less annoyance and labour of shifting from place to place.

Let us now recapitulate the case of steam and horse-power respectively per annum.

Cost per annum on Mr. Pullen's Farm.

	Of twelve horses.	Of steam cultivator.
Wages	£104 0 0	£74 0 0
Food—fuel	248 8 0	57 10 0
Repairs and maintenance ...	75 12 0	65 0 0
Interest of capital	15 0 0	18 0 0
	£443 0 0	£214 10 0

It is worth noticing how nearly the capital account is the same in the two cases; the horse and the implements displaced would cost 400*l.* (though Mr. Pullen, not having parted with the old implements, has not probably obtained from the sale of what has been displaced more than 300*l.* towards the buying of his steam cultivator), and the engine and apparatus, even with the present costly engine, have cost only 510*l.*

But it is not, as I have already said, on a mere *£ s. d.* estimate of *expenses* that the relative merits of the two systems are to be made apparent. It is in the quality of the work done by the two respectively that they will stand or fall.

The farmer and the landlord both appear from Mr. Pullen's experience to be interested in the extension of steam cultivation. That consumers are interested in such management is plain from the enormous produce of all kinds which his farm yields: and that the interests of the labourer do not suffer appears from Mr. Pullen's labour bill, which amounts to 1250*l.* a year, or, deducting 50*l.* for the 100 acres of grass land, to 40*s.* an acre.

It is proper to add that it appears to me that Sutton Courtney is more favourable as an instance of the Woolstone system than Peasemore is, as an illustration of Mr. Fowler's plan. In other cases in which the latter method has been carried out, a much smaller expenditure has been incurred both in maintenance of rope and in repairs of other parts, than appears to have been experienced at Peasemore. And of the various contrivances by which Mr. Fowler has since simplified and improved his apparatus as hitherto used upon the Peasemore Farm, an account will be given in the autumn, which is the other great season for tillage operations.

It is undoubtedly a great merit of Fowler's method of steam culture, that being especially adapted to large and systematic agriculture, it acts as a premium upon agricultural improvement. Both

it and the Woolstone system are, however, also well adapted to the more ordinary circumstances of most of our farms. The latter is probably especially fitted to a country of crooked, many-cornered fields. And to some minds it is no doubt the advantage of any novelty, which has proved itself worthy of adoption, that it interferes as little as may be with existing usages and circumstances. The existing condition of our clay land districts is not, however, a thing to be preserved; and as for the other chief subject, of even greater moment, with which steam-power in cultivation is likely to interfere, neither, we are bound to add, is the existing condition of our rural labouring population a subject over which a benevolent conservatism has any reason to be jealous. There is, no doubt, many a village where a firm, consistent, and benevolent character in the master has been working for years on that of his subordinates, and where one might lament any interference with the existing routine. Even here, however, the steam plough will destroy nothing that one would wish retained; besides which, it will be more profitable in the midst of an intelligent and well-conducted population than where ignorance, or carelessness, or spite is likely to do mischief. But these are the exceptions to the ordinary rule of country experience; and there are cases almost everywhere in which anything may be welcomed which shall break up the existing state of things.

It must not be supposed that the steam plough is to be a great moral agent, or that it is directly to bring about the renovation of character which is needed. It will, however, help to waken out of that stolidity to which gross vice is due; and at the least it is the merest folly to lament any disturbance which it may produce of the condition in which the agricultural labourer often lives.

III.—GRASS SEEDS AND SOWING.

Reference was made last month to the cultivation of clovers and grasses in alternate husbandry. The month of April is, however, the more general seedtime for this purpose; though for the seeding of land to be laid down in permanent pasture, probably some of the autumn months are as good a time as any; and I shall recur to this subject at that season, giving then drawings of both clovers and grasses, of which specimens cannot now (May, 1861) be procured to lay before the artist. It is intended now, however, to describe, in some detail, both the sorts of which our pastures are composed, and the management best adapted for their maintenance. It was stated at the London Farmers' Club the other day, that the grass lands of England, regarded as a whole, are a disgrace to the country. And there can be no doubt that the cultivation of those plants of which our natural swards consist is not practised so skilfully and

well as that of the grains and root crops cultivated on our arable lands. While the improvement of sorts, and the fertilization of the soil, have been laboriously effected in the case of plough-land plants, it seems to have been thought that the fescues, poas, clovers, and rye-grass of our pastures would yield their best though left to themselves. And, accordingly, the great majority of pastured acres in this country yield year after year just what the rain and sunshine cause them to bring forth, not merely without the aid of artificial stimulant or assistance, but in spite of many artificial drawbacks and disadvantages placed in their way. But grasses should be *cultivated* like every other plant we grow. Their character and habits, wants, and modes of growth should be studied and accommodated, just like those of wheat or mangold wurzel.

We can bring them, just as we can the others, under the influence of a perpetual movement of rain-water through the land in which they grow; and in their case, as in that of other plants, the great contrast between drainage and stagnation is ultimately exhibited. We can apply the manures they want: there is no class of plants so entirely under our control by such means. Mr. Lawes has for many successive years treated certain half-acre plots in the midst of a natural sward, each in a particular way, and the upshot now is that these plots are as differently planted as if sown out of different bags. In one the clovers and leguminous plants predominate, in another the true grasses. Nothing answers so readily as our pastures to the influence of manures. We can do a great deal to the direct extraction and removal of weeds. By perseverance in drawing them and in spudding them, and in mowing them; by continuous trampling, which destroys them and does good to other plants, we have the contents of our grass fields, as of our arable land, directly under our control. And we can even subject them with advantage to direct tillage operations. There is a sub-turf plough by which the under layer of earth can be disturbed, and it has been used with advantage; and there is even a subsoil plough for grass lands by which a deep cut is made, and a chisel-breadth of the lower earth is brought upwards and scattered over the surface. There are harrows for dragging up all moss and tangled, matted growth upon the surface, and opening that surface more directly to the air; and we have in Cartwright's harrow a capital contrivance for comminuting the manure which we apply, and bringing it directly in contact with the soil.

The use of all these means is open to the grass land cultivator. It is to him who merely *occupies* and does not cultivate such land, that Mr. Owen Wallis pointed when he spoke of the disgrace which our grass lands throw upon the British farmer.

There are instances enough in this country of immense improvement of grass lands by the use of these means of late years. By

the drainage of clay land pastures, the application of manures, and the consumption of cake and other foods by sheep upon them, their improvement is inevitable. And now, while mutton and wool both yield so good a price, is the time to carry such improvements widely out. I have lately been over an estate in Berkshire, where an energetic prosecution of these means is already putting an entirely different value upon the fields. The land had been to some extent drained on a rigid, up and down, "gridiron" rule with insufficient effect, when the proprietor, taking the matter into his own hand, condescended to accommodate himself to the habits of movement which the water had already acquired, and by drains up swampy furrows and wherever water lodged, which were at the same time numerous enough and evenly enough distributed to provide sufficient exit at four feet below the surface for all the water falling evenly upon the surface, the usual effects of a thorough drainage have been fully achieved and are now to be seen. Two cwt. of bones, two of superphosphate, one of guano, and one of salt, have since been spread per acre; and now the land is fully stocked with the heavy Lincolnshire sheep, and boxes containing cake and salt are to be seen thickly scattered over the fields. The grass lands of that estate were a "disgrace to the county:" they will soon be its pride. Already by such means a farm, chiefly grass, of 343 acres, formerly let for 313*l.*, has been sought on lease at 900*l.* a-year, after an expenditure of about 13*l.* an acre by the landlord. This, of course, is ample encouragement for him to proceed. And not for him alone, but for all other owners of clay-land pastures in similarly undrained, ill-cultivated, and therefore "disgraceful" condition.

Let us refer now to the different plants of which our grass lands should consist. The following memoranda on this subject, recently supplied to another publication,* may be repeated here.

Cultivated Grasses.—*Agrostis vulgaris* and *stolonifera*. The former is the so-called black twitch, found in dry sandy soils; the latter is the marsh bent, or florin, so extravagantly recommended by Dr. Richardson some years ago for wet and boggy soils. Two bushels of the florin seed, weighing about 36 lbs., would be needed for an acre if sown by itself—but it is rarely if at all so used—and when sown in mixture for marsh land, 1 or 2 lbs. to the acre are enough.

Alopecurus pratensis, meadow foxtail, is one of our most useful pasture grasses, yielding an abundant and early, succulent and leafy growth, extremely palatable to all kinds of stock. The seeds weigh but 4 or 5 lbs. a bushel, and 3 bushels or more per acre would be needed if sown alone; but this is never done. It is introduced into mixtures at the rate of 1 or 2 lbs. per acre.

* Sutton's "Farmer's Manual."

Anthoxanthum odoratum, sweet-scented vernal grass, is very early, and liked for the pleasant smell it gives to hay; but it is a poor innutritious grass, found chiefly on the lighter sandy soils. Half-a-pound an acre is quite enough to put into any mixture.

Arrhenatherum avenaceum, tall oat grass, is a coarse and somewhat bitter tasted grass, which is more properly a weed than a plant to be desired in pastures. Yet on dry and poor soils it may be desired, as furnishing a constant and bulky produce through the summer. Twenty pounds of seed would be used for an exclusive seeding of one acre, but it is rarely so sown; and even in the waste and rocky banks, where it is generally confined, 3 or 4 lbs., along with other sorts, are quite enough.

Brachypodium is a genus of coarse poor grasses, growing in sheltered and woody spots, and also in exposed seaside localities. All stock, except deer, are sure to refuse it; but as they like it, and it continues green through winter, it is well to sow some in coverts. From 5 to 8 lbs. per acre may thus be used.

Cynosurus cristatus, crested dog's tail grass, is a short-growing and comparatively innutritious grass: on account of the former quality, recommended for lawns; and on account of the latter, excluded from the mixtures which we sow for pastures.

Dactylis cæspitosa. Tussac grass has been introduced from the Falkland Islands, to waste and peaty soils on the coast of Scotland and its Islands, with some degree of success. It deserves promotion in such localities, for in its native country the plant yields a most useful fodder for cattle where nothing else will grow.—*D. glomerata*, cocksfoot grass, is one of our most useful meadow grasses, growing best on deep rich loams; it bears the shelter of overhanging trees, and in America is called Orchard Grass, for its fitness to such circumstances. It may be properly introduced into all mixtures, even those for grass to be laid down only two or three years; and 3 to 6 lbs. are ample seeding for such a purpose. Two or three bushels, weighing perhaps 30 lbs., would be needed if it were sown alone.

Elymus arenarius is a seaside grass, with long creeping stems and roots, well adapted for retaining blowing sands on the seashore, but of no other agricultural use whatever. The seeds are mixed with soil, as in lumps of clay, and then are dibbled into the sands, mixed with seeds of *Psamma*, another group of corresponding habitat; and 20 lbs. of the mixed seed per acre will be needed.

Festuca is the most valuable genus of our British grasses.—*F. pratensis*, meadow fescue, likes the stiffer class of soils, where it yields an even and abundant growth of most nutritive produce. It may be added to mixtures of grasses to be kept down only two or three years; but it is especially adapted to all permanent pastures.

If sown alone, 3 bushels or 40 lbs. would be required per acre. In mixtures, 2 or 3 lbs. suffice.—*F. elatior* also prefers clay soils. It is a coarser plant, with a tufted growth; and though willingly eaten by stock, it is not to be sown in preference to the species last named.—*F. loliacea*, darnel-leaved fescue, more recently introduced, is one of the most nutritive of grasses, and is found to thrive in almost every description of soil. Two to three pounds per acre are mixed with others for permanent pasture.—*F. heterophylla*, various leaved fescue, is remarkable for its brilliant green colour and slender foliage, which renders it very suitable for park lawns and pastures near mansions. Two pounds per acre added to the usual mixtures would be decidedly beneficial. It prefers a rather light soil.—*F. duriuscula*, hard fescue, is an early and permanent grass, of shorter growth than the other sorts, but of good quality, and very palatable, and therefore proper in all mixtures of grass seeds. A quarter of a bushel, or about 3 lbs. per acre, is a proper admixture.—*F. rubra*, red fescue, likes sandy soils, where its long creeping roots luxuriate. It is not generally to be recommended.—*F. ovina*, sheep fescue, is also a sandy soil plant, a short useful grass in all sheep pastures, where 1 or 2 lbs. of its seed may be sown in all mixtures.

Lolium perenne. Rye grass is one of our most valuable meadow grasses. Sown in mixtures for one or two year old grass, at the rate of 1 bushel per acre, and in mixtures for permanent grass, at the rate of 10 or 12 lbs., along with 30 or 40 lbs. weight of other sorts, it forms the principal portion of the produce. It will grow on all soils. A great many varieties exist, and are cultivated under the names of those who selected and introduced them.—*Lolium Italicum*, Italian rye grass, has been introduced during the last twenty years to British agriculture. It differs from the native species in its bearded spikelets and its larger growth. It is more succulent, and more palatable, and more productive. It is not a perennial plant, but dies after it has seeded. If, however, it be perpetually cut down, and not suffered to seed, it will continue to throw up its leaves and succulent stems for several years. At the rate of 5 or 6 lbs. per acre in mixtures for permanent grasses, and of a bushel per acre for two year old grass, *i.e.*, sown along with clovers in alternate husbandry, and at the rate of 3 or 4 bushels per acre when sown, as it often is, in richly manured lands alone, it yields a produce unequalled for quantity and quality. When thus sown alone, it is generally sown broadcast, in August and September, at the rate of nearly a sack per acre; and if the land be well tilled and manured, it will yield a heavy cut of grass in May and June of the following year. It ought then to receive a dressing of manure or of guano, through the water cart; and in seven or eight

weeks another heavy cutting may be obtained. When grown on farms on which there exists the means of flooding the land after giving a heavy dressing of manure, and so of washing the fertilizing matter into and about the roots of the growing plant, as much as seventy or eighty tons of green food have been obtained from it per acre in five or six cuttings during a single season. It is, however, only fair to say, that in dry summers, and on lands to which only ordinary attention in the way of manuring can be paid, it sends up a multitude of hard seed stems, without that luxuriant growth of succulent foliage which is the characteristic of the plant in more favourable circumstances. When sown in mixtures of clover seeds, 3 or 4 pecks per acre are scattered late in the season, as if put in too early it will be apt to overtop the grain with which it is sown, and so to spoil the crop. Further reference to this plant is made a few pages further on.

Phleum pratense, Timothy or herd grass, is another first-class grass, yielding a most palatable, nutritious, and productive food for stock. It affects clay soils, and yields abundant leafy growth, sending up its seed stems later in the autumn than most other grasses. One or two pounds of seed per acre is quite enough. The seed is very heavy and very small, and must be sown by itself, as it will not mix evenly with other grass seeds.

Poa nemoralis, wood meadow grass, grows readily in shaded places, and may be sown at the rate of 2 lbs. per acre in mixtures for orchards and overshadowed fields.—*P. pratensis*, smooth stalked meadow grass, grows readily in dry places, and may be sown in mixtures of 2 or 3 lbs. per acre; but by itself, as it sometimes is, for covering waste ground, it is sown at the rate of 15 or 16 lbs. per acre. It is not a valuable grass in comparison with many others; and it is not to be recommended for mixture with others on our best soils.—*P. trivialis*, rough stalked meadow grass, is best adapted for succulent moist soils. Two or three pounds per acre should have a place in all good mixtures for permanent pastures.

Psamma Arundinacea is a seaside grass, recommended for mixtures with Elymus, for sowing on blowing sands, as already mentioned.

We go now to some of the leguminous plants grown for forage and for pasturage.

Trifolium pratense, red clover, prefers rich adhesive loams, but is sown in alternate husbandry on all kinds of land. It is not generally a perennial plant, though so described by botanical writers. *T. pratense perenne*, or cow grass, is a somewhat more downy leaved plant, otherwise not very different from common red clover, except in its being a more perfectly perennial plant.—*T. repens*, the white clover, is generally sown in mixtures with the red clover, which

yields a more abundant and coarser growth. It is also especially adapted to calcareous soils.—*T. hybridum*, Alsike clover, is midway between the red and white sorts. In its habit of growth it is strictly perennial, and thus more permanent than *T. pratense*; and, from the depth of its roots, it is said to be better able to withstand a drought, as well as to prosper on otherwise clover-tired soils. Its flowers are rose-coloured and white, and its growth is large and bulky, like that of the red clover.—*T. incarnatum* is a crimson-flowered clover, very early, large and coarse in its growth, but very palatable to stock between early spring and flowering time; soon after which it becomes hard and woody. It is sown, 20 lbs. per acre, on any clean grain stubble, as soon after harvest as possible, without any preparation, and with only such a covering as a harrowing after a shower of rain will give it. Sorts varying in the period of their ripening have been introduced by Mons. Vilmorin, of Paris, so that sown the same day they come to the same stage of ripeness a fortnight after one another; and the crop is thus good and useful as forage for the supply of the stable during seven or eight weeks, instead of during only two or three, as when one kind only is sown.

Clovers are used in alternate husbandry over from one-quarter to one-eighth of the arable land of this country. Details of the ordinary practice of its cultivation are given at pages 152, 153, &c.

For permanent pastures a full mixture of 12 or 14 different grasses—40 or 50 lbs. per acre, in all—and 8 or 10 lbs. of the mixed clovers, are sown per acre, either in early autumn, if the soil is in good heart and well tilled, and sufficiently manured; or in the present month, when the mixtures are sown with a thinly seeded crop of barley. The mixture generally includes about 2 lbs. of *Alopecurus pratensis*, 1 lb. of *Anthoxanthum odoratum*, 3 or 4 lbs. of *Dactylis glomerata*, 12 or 14 lbs. of the various kinds of Fescues, and 4 to 10 lbs. of *L. perenne*, 2 or 3 lbs. of *Phleum pratense*, 2 lbs. each of *Poa nemoralis* and *trivialis*—in all 40 lbs. or more of grass seeds per acre. With these, 12 lbs. of mixed *Trifolium hybridum*, *pratense*, *perenne*, and *repens*, and perhaps 1 lb. of *Medicago lupulina* are added. The land should be reduced to as fine a tilth as possible, rolled flat, and the seeds should then be covered in either with a very short and frequent toothed harrow, or with the chain harrow, or with the bush harrow. The covering of the seed should be as light as possible; so long as the seed is covered and placed where it is at once moist, warm, and in the dark, it will germinate if it be alive. If covered with two or three inches of earth, every seed will perish. The depth of covering proper for grass seeds is discussed in page 135.

The following table embraces in a condensed form a number of

useful facts regarding the grasses and other plants which have been named :—

Grasses, Clovers, &c.

Botanical Name.	Soil preferred by it.	Weight per bushel.	Seeds per lb.	Proportion pr. acre sown in mixtures.	Time of flowering.
		lbs.	No.	lbs.	
<i>Agrostis stolonifera</i> ...	Moist places.....	13	8,000,000	1 lb.	May.
<i>Alopecurus pratensis</i> ..	Stiff soils	5	1,200,000	1 to 2 lbs.	"
<i>Aira cespitosa</i>	Moist moors.....	14	2,000,000	1 lb.	"
<i>Anthoxanthum odor</i> ...	Sands	8	1,100,000	2 to 3 lbs.	April.
<i>Arrhenatherum aven.</i> ...	Dry gravels	7	320,000	4 to 5 lbs.*	May.
<i>Cynosurus cristatus</i> ...	Lawns	26	440,000	6 lbs.*	June.
<i>Dactylis glomerata</i> ...	Deep rich soils.....	12	600,000	3 to 6 lbs.	May.
<i>Elymus arenarius</i>	Sea coasts	11	37,000	10 lbs.*	"
<i>Festuca duriuscula</i> ...	Dry pastures.....	12	640,000	2 to 3 lbs.	June.
<i>F. elatior</i>	Moory soils	14	320,000	2 to 4 lbs.	"
<i>F. heterophylla</i>	Adhesive soils	10	520,000	1 to 2 lbs.	"
<i>F. ovina</i>	Light do.	14	100,000	1 to 2 lbs.	May.
<i>F. pratensis</i>	Moist do.	20	42,000	2 to 6 lbs.	June.
<i>F. rubra</i>	Light dry soils	12	62,000	?	May.
<i>Holcus lanatus</i>	Moory soils	7	1,500,000	1 lb.*	July.
<i>H. mollis</i>	Light sands	6	130,000	4 lbs.*	"
<i>Lolium perenne</i>	All soils	18 to 30	240,000	10 to 12 lbs.	June.
<i>L. Italicum</i>	All soils	15 to 20	400,000	6 lbs.	"
<i>Phleum pratense</i>	Warm clays	44	1,200,000	2 to 4 lbs.	"
<i>Poa nemoralis</i>	Shaded woody spots	15	2,700,000	2 to 3 lbs.	"
<i>P. pratensis</i>	Light and dry	13	3,800,000	2 to 3 lbs.	June.
<i>P. trivialis</i> .....	.....	15	3,400,000	2 to 3 lbs.	"
<i>Psamma</i>	Sea coast	15	160,000	8 to 10 lbs.*	"
<i>Trisetum flavescens</i> ...	Dry cool	5½	1,800,000	1 lb.	"
<i>Achillea millefol.</i>.....	.....	30	3,000,000	1 lb.	"
<i>Cichorium intybus</i> ...	Loam	32	336,000	1 to 2 lbs.*	"
<i>Lotus corniculatus</i> ...	Dry places	62	500,000	½ to 1 lb.	"
<i>L. major</i>	Moist places.....	64	800,000	½ to 1 lb.	"
<i>Medicago lupulina</i> ...	Inferior soils.....	63	250,000	1 to 2 lbs.	"
<i>M. sativa</i>	Calcareous loam	60	200,000	—	"
<i>Onobrychis sativa</i>	Chalky soils	26	21,000	—	"
<i>Plantago lanceolata</i> ...	.....	50	250,000	—	"
<i>Poterium sanguisorba</i>	Chalks	25	53,000	2 lbs. ?	"
<i>Trifolium hybridum</i> ...	Loam	63	72,000	2 to 3 lbs.	"
<i>T. pratense</i>	"	64	250,000	3 to 4 lbs.	"
<i>T. repens</i>	"	65	512,000	2 to 4 lbs.	"

It is proper to add, that the practice of laying down pasture lands, by what has been called "inoculation," has been recommended, but I believe on insufficient grounds.

The practice consists in paring an acre of good pasture, chopping it up into pieces about two inches square, gathering them into carts, and taking them and spreading them out over as much as ten acres of well-tilled and manured arable land; where they are placed by children, who are directed to tread them in, one to about every square foot of ground, right side up. These tufts will soon take root, and to some extent no doubt spread, and so the ground will be covered. A half allowance of grass seeds is sown over all, and the whole is rolled down. The result, however, is a rather tufted and hassocky sort of growth on the field for a year or two, before the

* The Grasses and other plants marked thus * are sown only under particular circumstances, or for special purposes.

field is fairly established. And a more even result is to be obtained by carefully sowing a proper mixture of seeds over a smooth well-tilled surface of good soil, and lightly covering them.

As to the subsequent treatment of the young plant, Mr. Thompson, M.P., in a recent number of the *Journal of the Agricultural Society*, emphatically condemns the practice of putting sheep into young pastures. He never succeeded in laying down pastures satisfactorily, until he made it a rule to exclude sheep from them for several years, stocking the land with young cattle for a year or two, until the turf was close and strong enough to bear the treading of heavy cattle.

The following table of seeds proper for sowing on an acre of land under varying circumstances is given on the authority of Mr. Lawson* :—

Seeds for Permanent Pastures.

Names of Grasses, &c.	Light soils sown		Medium soils sown		Heavy soils sown	
	with a crop.	without a crop.	with a crop.	without a crop.	with a crop.	without a crop.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
<i>Aira cæspitosa lutescens</i>	—	—	1	1	1	1
<i>Alopecurus pratensis</i>	1	1½	1½	2	2	3
<i>Arrhenatherum avenaceum</i>	—	—	1½	1½	2	2
<i>Avena flavescens</i>	1	1½	1	1	—	—
<i>Dactylis glomerata</i>	2	2	2	2	3	3
<i>Festuca duriuscula</i>	2	3	3	3	2	2
— <i>heterophylla</i>	1	1	1	1	2	2
— <i>elatior</i>	—	—	—	—	2	2
— <i>lohiacea</i>	—	—	1	1	2	3
— <i>pratensis</i>	—	—	2	2	2	2
— <i>rubra</i>	2	3	—	—	—	—
<i>Lolium Italicum</i>	3	3	3	3	3	3
— <i>perenne</i>	5	5	5	5	5	5
<i>Phleum pratense</i>	—	—	1	1½	2	2½
<i>Poa nemoralis</i>	2	3	3	—	2	3
— <i>pratensis</i>	1	1	—	—	—	—
— <i>trivialis</i>	—	—	1	1½	2	2½
<i>Medicago lupulina</i>	1	1	—	—	—	—
<i>Trifolium pratense perenne</i> ...	3	4	3	4	3	4
— <i>repens</i>	4	5	4	5	4	5
	28	34	33	38½	39	45

When the seeds are sown by themselves, that is, without a crop of corn overshadowing and nursing them, it may, nevertheless, be well to sow a bushel of barley or rye as a thinly growing protection.

Mr. Thompson's experience of the management of young pastures is described by him as follows :—

"About twelve years ago I took in hand thirty acres of land adjacent to the river Ouse, which I was desirous of laying down to

* Lawson's "Agriculturist's Manual."

permanent grass. Fifty years before it had formed part of my grandfather's home-farm, and had the repute of being good feeding pasture. He was tempted to plough it out by the excessively high price of corn, and the first three crops he had upon it averaged ten quarters of oats each (worth 3*l.* per quarter), and realized more than the fee-simple of the land. But when the war prices had passed away the land still remained under the plough, and as it was loam of tolerably good quality, and very favourably situated for pasture, I resolved to try my hand at it, and to spare no reasonable expense in bringing it quickly back to its original state of good feeding pasture. It was therefore fallowed, limed, and sown with rape, which produced a good crop and was consumed on the land by sheep; the seeds were then sown down without a crop, great pains having been taken to procure the most suitable grass-seeds for that description of land. They came up well, and the following spring were unusually luxuriant, and I was congratulated on the success of the operation. I was at that time thoroughly impressed with the truth of the Persian proverb, that 'the sheep has a foot of gold, and turns to gold whatever it touches,' and I accordingly resolved that sheep, and sheep only, should for some years enter my model pasture. The quantity of sheep which this field carried in the early months of the first season was very great, not less than ten or twelve to the acre, and I flattered myself that so many feet of gold could not but produce a splendid result. Before the end of the summer, however, the rye-grass sent up its seed-stems, which the sheep would scarcely touch, and the keep then declined sensibly, and did not carry any quantity of stock after Midsummer. The field was very green the following spring, and carried a good many ewes and lambs in March and April, but its growth was much below that of the previous year, and as the grasses (especially rye-grass and crested dogstail) threw up their flowering stems, the pasture fell off both sooner and more completely than before. I was rather disappointed at this state of things; but knowing that the *second* and *third* were very trying years for all newly-laid grass, I determined to make such a liberal application of the golden foot as should terminate all suspense, and at once make this field what it ought to be.

"Accordingly, as soon as the grass was about six inches high the following spring, I penned a large flock of yearling sheep upon it, giving them a fresh break of grass every day, together with as much linseed cake as they would eat. They cropped the pasture quite close, and when the flock had gone round the field, a fresh growth having sprung up, they were taken over it in the same way a second and a third time, until they had consumed several tons of linseed cake, and made themselves very tolerably fat. The effect of this treatment was to produce a great rise of white clover, and the

grass, though short, seemed sweet and succulent. Next year I expected to see a marked change in the pasture, but was much puzzled as well as disappointed at not being able to perceive any decided improvement. I still, however, believed this to be the most efficacious way of enriching grass-land, and resolved to give it a further trial. I accordingly again penned sheep on the land, giving them as before a full allowance of linseed cake and a fresh break of grass daily. This year convinced me that I was altogether on a wrong tack, as the pasture looked decidedly worse at the end of it than it had done yet. The finer grasses were getting scarcer, instead of increasing, and the white clover, though it did not immediately disappear, looked small and stunted. By close observation I became satisfied that the constant cropping of the sheep had a very prejudicial effect on all the finer grasses, and that those only which they partially rejected could make head against this repeated gnawing into the quick. I have been thus particular in describing the result of this experiment, because it gave me the clue by which I was able to interpret several previous instances of failure or very doubtful success, and has been of great benefit to me in subsequent years.

"This was a singular but well marked case, in which there could scarcely be any mistake. The land was of more than average quality; the seeds came up well, and during the first season were strikingly luxuriant, whilst the subsequent treatment was such as to supply the land with an unusually large amount of fertilizing matter of the richest kind: nothing, in short, was wanting but success! Yet the failure was so marked, that the most careless farmer could scarcely have avoided pondering over it and trying to discover a solution of the riddle. I was slow, indeed, to give up my perfect confidence in the fertilizing tread of the sheep; but after the failure of repeated endeavours to find any other sufficient cause, I was reluctantly brought to the conviction that amongst young grasses the gnawing tooth was more than a match for the golden foot. Nothing, in fact, but the repeated cropping could explain the gradual but steady dwindling of the clovers and finest grasses, notwithstanding the uniform consumption over the land of such an amount of linseed cake as would, if applied in the usual mode to any ordinary grass-land, have produced a luxuriant development of all the best fodder-plants. Following up this idea, I became satisfied that to graze sheep on young seeds intended for permanent pasture was a mistake, and that in all probability it had been the cause of several previous failures. Up to that time I had never succeeded to my own satisfaction in laying down land to grass; but since making a rule rigidly to exclude sheep for some years from newly-laid grass during the season of active growth, I have never had a failure, though I have twice had occasion, for local reasons, to lay down fields of which the soil was strong clay. The method

which I have found to answer best has been to sow a liberal allowance of the hay-seeds of the district, with a sprinkling of cow-grass and white clover; to sow them with a crop of wheat (one of the short-strawed varieties); to mow the first year, and as soon as the hay is removed, to give a good dressing of farmyard-manure, and then for some years pasture it with cattle, beginning for the first year or two with young stock, until the turf is close and strong enough to bear the treading of heavy cattle. If farmyard-manure is not to be had, three cwt. of best Peruvian guano per acre will prove a tolerable substitute, though by no means equal to the former. For some years a newly-laid pasture will, unless the land be of *very* superior quality, require assistance from time to time to keep it in an improving state; an occasional dressing of farmyard-manure is, of course, the best, but as this is rarely obtainable in sufficient quantity, it must be eked out by other means. One of the cheapest and most effective plans is to employ an old man with a donkey-cart to go round the pastures collecting the droppings of the cattle and making them into compost with road-scrappings, ditch-cleanings, &c.: when these sources fail, the droppings must be mixed with ordinary soil, avoiding sand, gravel, and lime. If a manure-collector be once appointed, numerous odds and ends of fertilizing substances will be found available which would individually be worth little, and which are now wasted because the regular staff of the farm are all engaged, and to take off one horse and man would often stop a plough or weaken a gang of labourers so as materially to interfere with more important operations. But the collection of manure should be incessant. The droppings of horses and cattle, especially if collected fresh, form a very important source of compost, and the improvement to the pasture is twofold: first, in the saving of that which is otherwise to a great extent wasted; secondly, by the cleansing of the pasture and the much more uniform grazing of the cattle when the droppings are not allowed to remain and produce coarse tufts for some months after. In collecting materials for compost, it should be borne in mind that all plants contain more or less of the elements required for the growth of the grasses, and that thistles and other succulent weeds, if mown and covered with soil whilst still fresh and sappy, materially assist in improving the heap, both by the fertilizing elements which they contain and also by the fermentation which they induce. This fermentation mellows and disintegrates the soil, and also fills its minute pores with gaseous matters, the result of the decomposition of the vegetable and animal compounds of which the compost should be partially composed. All compost should be turned and well mixed, once at least. The time that it should be left before and after turning will depend entirely on the materials of which it is composed. As a general rule, however, it may be

assumed that the droppings of cattle, mixed with road-scrapings, will be ready for use during the winter after their collection; but if rougher materials be used, twelve months will probably be required to bring the heap into the friable state which is desirable. I attach particular importance to this collection of *vegetable mould* for top-dressing newly-laid grass-land."

On the subject of manuring grass land, however, no statement is complete which omits the account of Mr. Lawes' experiments already named on the manuring of grasses and clovers. It must suffice to say that he has for several years subjected to a constant manuring of different kinds a series of half-acre plots of grass land in his park; and the consequence is, that from a uniform mixture of grasses and clovers proper to a good pasture, or one of average quality, he has by his persistence in one manuring alone on each of his plots, so influenced the character of the herbage on those plots, that they now appear as if they were the growth of differently seeded plots. The ammoniacal manures have so promoted the growth of grasses, that they have flourished, to the ultimate exclusion of the leguminous plants. While, where the phosphates and alkalies were sown in mixture annually and constantly for several years on others of his plots, clovers and other leguminous plants have flourished, to the relative exclusion of the true grasses. The results are marked and well defined in a very extraordinary degree; and we may fairly infer from them that all grasses flourish under the use of salts of ammonia, guano, nitrate of soda, and other nitrogenous manure; while clovers are fostered and encouraged by manures containing the alkalies and the phosphates. It is in the use of such manures—in the retention by rolling of a sufficient firmness of soil during the winter—in the use of lime to utilize and bring into activity whatever of fertilizing matter there may be in the land; and above all in the diminished frequency with which crops of the same kind succeed one another on the land, that we may hope to escape clover-sickness, so destructive to the clover crop in many old arable districts, especially of light land.

The practical conclusions on manuring to which Mr. Lawes' experiments have led him are stated by him as follows:—

"In order that the more temporary, or more rapidly acting means of increasing the produce of meadow land, may have their full effect, the more permanent means of amelioration that may be required—such as draining, marling, liming, and the like—must not be neglected. The application of bones is not recommended for general adoption. They appear to be chiefly adapted to the exhausted pastures of certain localities, and not to be generally applicable to meadow land which is mown for hay. The hay crop is a great exhauster of the mineral constituents of the soil; and these, owing to the high price of salts of potash, cannot, with profit, be

fully restored in artificial manures. The return of the mineral constituents is better accomplished by means of farmyard manure, stable dung, night soil, and the like; which, at the same time, bring on to the land a more or less considerable quantity of available nitrogen. The best '*artificial*' manures for grass land are, Peruvian guano, which is rich in phosphates as well as nitrogen; and nitrate of soda, and sulphate of ammonia, which are rich in nitrogen, but contain, of course, no phosphates. Peruvian guano, when used alone, may be employed at the rate of from one and a half to two and a half cwt. per acre; nitrate of soda alone, or sulphate (or muriate) of ammonia, at the rate of one and a half to two cwt. per acre. The salts of ammonia are, however, relatively too expensive to be employed largely with profit; and both ammoniacal salts and nitrate of soda are more advantageously used in combination with guano. A very generally useful top-dressing for the hay crop may be made of three parts Peruvian guano, one part nitrate of soda, and one part sulphate of ammonia. Of this mixture, two to two and a half cwt. per acre may be employed. With this applied annually, and the application of ten or twelve tons per acre of poor rotten dung once every four or five years, a good crop of hay may be taken off every year, without injury to the land. The best time of sowing the '*artificial*' manures is generally in January; and it should at any rate be seldom postponed beyond February."

We may gather from the fact that manures exert so great an influence on the future grass field, the importance of the land being in good order when the seeds are sown. Probably a repeated green and fallow crop, as mangold wurzel followed by turnips, with a dressing of lime between, and the latter, if not both, being fed on the land by sheep, would be as good a preparation as possible; and when the land is naturally a good loam and the crop subsequently treated properly, as Mr. Thompson has described, the experience of its cultivation will be more encouraging, and the character of the produce, both as to quantity and quality, will be continuously good.

Italian Rye-grass.—This is almost the only grass cultivated by itself for its own green produce alone. No other grass, and probably no other plant, will so well repay a rich and liberal manuring. Grown on a poor soil, or under a dry climate, it throws up benty seed stems without succulence, which only have the effect of deteriorating the land for the subsequent wheat crop. Grown on land, whether rich or poor naturally, which is supplied artificially with ample stores of ammoniacal manures, especially if given in the liquid form, there seems hardly any limit to the luxuriant growth of its juicy leaf and stem, forming the best possible forage during summer to stall-fed cattle.

Under ordinary tillage, Italian rye-grass prefers the adhesive

class of soils—loams and clays. The quantity of seed to be sown if grown by itself is 3 to 4 bushels per acre. When sown with a mixture for permanent grass, 8 lbs. or 10 lbs. per acre is an ample share. When sown with clover, 1 bushel per acre, with 12 lbs. of mixed clover seeds, is abundantly sufficient. In that case it should be sown as late as possible along with the grain crop, as, for instance, hoed in early in May. If sown as early as usual it would, by its rapid growth, materially interfere with the harvesting of the crop. But for a full crop it is best sown by itself, *i.e.*, without a grain crop; and then, though the end of April or early May is often chosen as its seedtime, soon after harvest is preferable. Mr. Drummond recommends 2 or 3 lbs. of alsike clover to be sown along with 2½ bushels of Italian rye-grass as early in autumn as possible. At the first cutting, early in the following summer, this alsike clover is often eighteen inches high, and the whole is a very heavy crop. Mr. Sutton recommends to sow Italian rye-grass by itself—making an exception, however, in favour of *Trifolium incarnatum*, if it be sown in August—a very large crop of both is obtained, and the trifolium is made surer and more abundant for its nursing by the earlier rye-grass.

A great deal of the success of the crop depends upon the choice of seed. It may not be of a good sort, for there are varieties; it may be imperfectly ripened; it may be imperfectly winnowed; and it may be adulterated. Its weight varies from fifteen pounds per bushel up to as much as twenty-eight pounds. It is much adulterated with hair-grass and common hay seeds; and its varying weight indicates how much mere husk is often mixed with it even if it be a genuine sample.

As to the produce under ordinary management, it will yield three good cuttings in the year, if watered with the water-cart as industriously as possible, and if the land be in good heart to begin with. But if watered copiously—as it can be only by a system of underground pipes and tanks and force-pump—you may have four up to eight cuttings, according to the stage of growth at which you wish to take it. It may be cut later than ordinary rye-grass, for it does not become so woody at the same degree of ripeness; and it will do to cut very young also. If allowed to seed, Italian rye-grass yields a fair crop. I once sold ninety sacks, *i.e.*, 360 bushels, weighing seventeen pounds a bushel, off nineteen acres, and this was not a good crop; it was a second cutting that year. The seed is difficult to save, from its liability to shed. The swathe was tied up in small sheaves at once and stooked as wheat is, and carried at once to the board upon a large sheet in the field, where a couple of men could thresh it out almost as fast as a horse and cart could fetch it; two or three blows upon each sheaf sufficed to knock the seed out.

It is, however, under copious dressings, by steam-driven pumps,

of liquid manure, or of water after guano has been spread broadcast, that Italian rye-grass yields most abundantly. It is doubtful whether the earlier attempts at carrying out this system by subterranean pipes were profitable, though they were undoubtedly successful so far as the yield of enormous produce was concerned. Nevertheless, I will describe one of them, because it was the most remarkable specimen of an artificial fertility that I ever saw.

As you approach Ayr by railway from the north, the sea upon your right is hidden by a waste of sandy hillocks but imperfectly bound together by the wiry roots of the scanty grass with which in patches here and there they are covered. This is, in fact, a district of blown sea-sand, in which rabbits burrow. On your right, again, the same sand has been levelled and is cultivated, and by dint of manuring is made to grow turnips and other food for sheep, which there, as everywhere, at length impart fertility. Through this sand the water of Ayr finds its passage to the sea, and on its banks the town is built. South of the town the same kind of soil occurs, in a narrower line, however, along the shore, and it is soon altogether stopped by the high lands close by the sea. Before you reach these high-lying lands—and before you leave the sandy tract—you come as you travel southwards, upon the farm of Canning Park. It is an old enclosure from the blown sand of the shore—fifty acres in a rectangle lying between the south road and the sea—formerly, no doubt, a sandy waste; and while the difference from the wilderness it was, which *to the farmer* it exhibited when I saw it, was at least as great as that presented by the richest specimens of fertility I know, that difference was in this case wholly due to art and not to nature. The sand on some of its extent has been heavily clayed, and has yielded heavy crops of wheat, but a great deal of it that I saw was as light a sand as was ever cultivated—a pure sand soil which, when dry, the frost of winter fails to make cohere. The manure applied to these acres, when in the occupation of Mr. Telfer, consisted of (1) an endless supply of water: (2) the whole liquid and solid excretion of forty-eight cattle in the byre, which were highly fed on food grown and purchased; (3) 10 cwt. per acre of artificial manure over the whole of the extent in Italian rye-grass, $6\frac{1}{2}$ cwt. of guano per acre over the cabbage and mangold wurzel, and about $2\frac{1}{2}$ cwt. per acre over the whole of the wheat.

The grass was allowed to stand till on the point of putting forth its seed-stem; it is then more substantial food, containing less water and more starch and sugary matter. When younger it contains, along with more water, more of the substances corresponding to the gluten of flour, and which chemists tell us resemble the fleshy part of animal matter. Those who wish to make flesh by their consumption of Italian rye-grass may, therefore, be right in cutting frequently and having it younger. Mr. Telfer made butter, and

was right in cutting it less frequently—often only three, sometimes four, or at most five times in the year. He had a drier food in consequence. His object was to have a food for his cows containing twenty to twenty-five per cent. of solid matter, and he mixed chaff, and hay, and meal with his mangold wurzel during winter in order to obtain this result.

The Italian rye-grass was, as a general rule, the whole maintenance of the stock, so far as green food goes, during the months of May, June, July, August; most of their maintenance in September, and half their maintenance in April and October. In the year I saw it, $8\frac{2}{3}$ acres of Italian rye-grass, half of it sown in the spring of the previous year (for the seed had not been put in in the autumn as usual), had yielded 270 tons of green food, besides a crop of hay off the old grass which was left for hay in the autumn, the younger crop being then in full bearing, and sufficient for the feeding of the cattle.

Let me give the history of an acre of Mr. Telfer's rye-grass. It was sown in autumn, about four bushels per acre, and brushed in and watered and left till spring. It yielded a first cutting perhaps in June, when ten or twelve tons per acre might be expected from it. Immediately after cutting, between three and four cwt. per acre of mixed Peruvian guano and sulphate of ammonia were sown upon it, and one inch, or one hundred tons per acre of water were poured upon it through the pipes, containing such a share of the liquid excrement of forty-eight cattle as belonged to the period since the last pumping took place.

The flooding followed the cutting immediately: the Italian rye-grass uses the ammoniacal manure especially during the early stage of its growth, and by applying the liquid at once, it gets the start of all weeds. In five weeks the land was covered three feet high with a thick, luxuriant growth, weighing dry, *i.e.*, without dew or rain upon it, at least sixteen to twenty tons per acre. This was cut and followed by another manuring in a similar manner, and a third cut of sixteen to eighteen tons was expected pretty early in September, and a further manuring gave you ten or twelve tons per acre towards the end of October. In spring another dressing of the water gave a cutting towards the end of April, and a second and third cutting were had, together weighing forty-five to fifty tons per imperial acre, by the end of August. The land was then allowed to grow the crop unassisted, and a crop of hay or seed might be had in the early part of October, after which it was broken up. During the two years that acre had yielded between eighty and a hundred tons of green food per acre, in seven cuttings, by the use of a ton of guano, sulphate of ammonia, and nitrate of soda, washed in with 700 tons of dilute liquid manure. I am not stating this as an actual history, but as what

I believe to be a moderate estimate, founded on the information I obtained.

It may be right to add a word or two on the hay made from this plant. It is, of course, under its ordinary management, as proper for conversion into hay as any other rye-grass—more proper, if excellence for this purpose depends upon abundant produce of palatable food. But under the irrigation system, where the second cutting follows so quickly on the first—where such very heavy, almost unmanageable produce is obtained, and, above all, where the success of the management depends upon the land being flooded with liquid immediately upon its being cut—it is not advisable to make hay. Hay is made from it, then, only in such cases as when a cutting of the old grass remains unfinished, while the first cutting of the new is ready—or whenever the growth accidentally or by mismanagement overtakes the consumption. Then that which cannot be consumed at once is cut and made into hay—and very good hay it makes.

IV.—GRAIN CROPS.

Wheat is now generally in full growth, and in mild spring weather will soon cover the ground. Where it is too luxuriant, sheep may be herded on the land, and allowed to crop the overgrowth; or the scythe may be used to mow the top leaf off. The young plant, if dissected, will already show the form and position of the young ear, and a little care will save it from injury, while the removal of the overshadowing leaf will tend to the strengthening of the stem, and so to the hindrance of any liability to be laid by heavy rain. The “April” wheat may still be sown on any late piece of sheepfold which is expected to yield a more valuable crop of wheat than of barley.

Barley and oats are both sown this month to a considerable extent, especially in the southern counties; and heavy crops are often had off late sown fields. It is, however, never to be recommended to delay the seed time of these crops beyond March when it can be avoided. A better produce both as to quality and quantity is obtained from the earlier sown crops.

Hoeing operations are the principal employment of April among all our corn crops. The earlier sown peas and beans will need the horse-hoe; and most of the wheat, barley, and oat fields will need either horse or hand hoeing. The operation should be preceded by a rolling; and the horse-drawn implement (to be hereafter figured in these pages), or the hand-hoers follow it. In the former case, it may cost 1s. an acre, and in the other from 3s. to 5s., according as the width of drill enables the use of a wide or narrow hoe, or according to the foulness of the land. Where it is free from couch grass, and infested merely with annuals, as chickweed or speed-

well, a sufficient cultivation and destruction of the surface and its weed-growth is effected by the harrow. Where the corn horse-hoe is used among young wheats, an implement which takes as many rows at once as had been sown at once by the drill is used. And any variations from the straight line being followed alike by all those rows together, can be also followed by the hoeing implement. The man who guides it keeping his eye on a single row, and saving it, is sure to save the whole. This horse-hoe, followed next month by men with spuds for the removal of thistles in the rows of corn, is a cheap and efficient substitute for the much more costly process of hand-hoeing.

It is to be remembered that this tillage of the soil during the growth of the plant is useful not merely for the removal of its enemies, which is thus effected, but for its stimulating influence on growth. Growth is essentially a process dependent on the activity of those chemical processes going on within the soil which tend to the provision of vegetable food. These processes are quickened by a stirring, which acts on the soil as a poking does on the fire in the grate; and all the products of a renewed chemical action are as much a manuring as if the fertilizing matters thus supplied were directly added to the land.

Soluble Manures may be applied to unpromising corn crops early in this month. Sulphate of ammonia or nitrate of soda may be thus applied broadcast, before rain if possible, at the rate of one cwt. per acre. There are especial advantages in the case of all corn crops in the attainment of a vigorous habit of growth when young, and on this account tillage and manure brought to bear upon them early in the spring exert an influence upon the future crop which is not witnessed in the case of green crops.

Let us take the wheat plant and the turnip respectively as representatives of these two classes. In the latter case, the efforts of the farmer are all bent upon obtaining size of bulb: this is the one point which is the object of cultivation; and, however backward the plant may be at an early stage of growth, genial weather and good cultivation may start it again, and quite remedy previous bad fortune: its size will increase under such influences; its growth is from the beginning to the end a mere process of accumulation—a mere work of addition. In the case of wheat, however, there are several parts to be looked to. It is the seed which is here important; and the farmer aims not only at obtaining size but number also. This number depends on two circumstances—the tillering of the plant, which increases the number of ears from each root, and the size of these ears—the number of seeds on each. The former of these particulars, equally with the latter, renders it of great importance that plants should be placed in such circumstances when young as will enable them to grow vigorously; but, it is to the latter

point especially that I wish to direct attention. I have pulled a wheat-plant early in April, when barely six inches high, and on dissecting it have laid bare the embryo ear, then hardly the tenth of an inch long, and by the help of a microscope I have counted the buds upon it, at this early period—the buds from which the flowers and the seed are to spring. Now this embryo ear in the month of April appeared to possess about the same number of parts, each in an embryo state, as the average of perfect ears; and though I do not know that the ear of corn is formed in embryo perfect, so far as *the number* of its parts is concerned, from the first, yet it is extremely unlikely that in this case any addition would have been made to the number of those parts, for that was already as great as is usually observed. How important, then, that during the very early period, when this number admits of increase, the young plant should be in a vigorous condition! No future exertions, seconded though they may be by genial weather, will here remedy a fault occasioned by inattention during the first stages of the plant's growth. It is *then* that the limits are assigned to *number*, and any future vigour on the part of the plant must expend itself in the production of size, and in the full filling up of all the parts which have been formed in an embryo state. This latter point is doubtless of great importance, and the farmer, by all means in his power—a right preparation of the land and due thinness of sowing—must endeavour to push the plant on so as to induce the fertility of all the buds on the ear, which is, be it remembered, of rare occurrence; but let him, by careful attention to these same means, endeavour, in the first place, to obtain length of ear, and such a number of buds on each as, if all brought to perfection by a good season, may result in a large crop.

V.—FLAX CULTURE.

In the first edition of this work considerable space was occupied by a detailed account of Flemish agriculture. This is omitted now; the principal points dwelt upon in it were the careful weeding, the use of liquid and other manures, the peculiarities of the prevalent crop rotation, and the characteristic cultivation of flax. All these points are being referred to in our pages as occasion offers, and according to English experience and farm practice. And while the culture of flax in this country may be copied with advantage from that of Belgium, we prefer to state the experience of our own farmers even in cases where that example has been followed.

The two following pages, accordingly, are, for the most part, abridged from a paper contributed many years ago to the *Agricultural Gazette* by Mr. Sproule, of Dublin, who has had large experience in flax cultivation:—

In the cultivation of flax, the selection of the soil is a primary consideration. It prefers strong loamy land, such as is best adapted for the growth of wheat. Adhesive clays and light sandy soils are equally unsuited for it, as also all soils containing any considerable portion of peat in their composition. On heavy clay soils, it is difficult—indeed, almost impossible—to attain that perfect state of pulverization which is essential for the successful growth of flax; and on the class of extremely light upland soils, the inferior quality of fibre produced sufficiently indicates that such are not the proper soils for that crop. In the case of reclaimed bogs, a great length of time must elapse, and the character of the soil be completely changed, before it is fitted for flax-culture.

The state of the land with regard to fertility, is also deserving of notice. The direct application of manure to the flax-crop is found to be injurious, producing fibre of so coarse a quality as to be almost worthless; yet a high degree of fertility in the soil, by previous manuring or otherwise, is indispensable. These remarks have especial reference to the manure of the farm-yard. Liquid manure is, however, advantageously applied to the flax-crop in Flanders, the quantity being regulated by the wants of the soil. The effect of enriching the soil beyond a certain degree, for this crop, causes it to grow so luxuriantly, that the strength of the stem is unable to maintain it in an erect position; and when laid down before being ready for pulling, the crop is spoiled. In this respect, flax is subject to the same rule as our cereal crops, to which an excess of manuring proves decidedly injurious, and differs from the root-crops, for the successful growth of which an excess of fertility can scarcely exist in the soil.

The place for flax in the rotation is after grass or clover lea, or a corn-crop; but in the latter case it should be the second crop after the land is broken up from grass. It may be successfully grown as the first crop after the land is taken up from grass; but the preparation for the flax is in this case more difficult, and a valuable corn-crop may then be grown without injury to the succeeding crop of flax. When taken after a richly manured green crop it produces coarse fibre; and it must not be grown on land which has been recently limed. Lastly, it must not be frequently repeated on the same land—not oftener than once in every seven or eight years.

The preparation of the land for flax should be similar to that for the carrot—perfect pulverization of the soil to a considerable depth, and the thorough eradication of weeds, being the objects to be attained. Early ploughing in the autumn, followed by a sufficient autumn tillage, and the application then, if at all, of any manures that are to be used, followed in the spring by repeated stirrings with grubber and harrow, will in general be sufficient for this purpose.

Deep pulverization is much more important in the preparation of the land for flax, than is usually imagined ; it having been repeatedly ascertained that, under favourable circumstances, the roots of the plants will strike into the ground fully one-third of the entire length of the stalk.

To ensure the regular and even germination of the seeds, the surface of the ground should be firm and perfectly level before sowing. It is usual, immediately before sowing, to give a good rolling to the ground, after which light harrows follow before the seeds are sown. Another slight harrowing and rolling afterwards finish the seed process. The proper seed-time is during the present month, and as early as possible in the month, the precise period being of course regulated by the weather and consequent state of the land. Flax is repeatedly sown in Ireland in the month of May, although experience has abundantly confirmed the propriety of an earlier seed-time.

The quantity of seed will in some degree depend on the chief object in view in the cultivation of the crop ; but in these countries hitherto it has almost exclusively been cultivated for its fibre, the seed being, in the majority of cases, altogether disregarded, and allowed to go to waste ; and there is little doubt that the prevailing practice has been to use too small a quantity of seed. When the saving of seed is a principal object, thin sowing will better answer the purpose in view. The production of the largest quantity of seed is indeed incompatible with the greatest return from the fibre ; but the latter being the more valuable, the production of seed is to be regarded as a secondary consideration. Thin-sown flax branches much towards the top, which produces an increased quantity of seed. It is, however, worthy of remark, that the plants from which the finest fibre is produced have rarely more than one seed-pod each,—in fact, not more than one in twenty having more than a single capsule. The cultivator, therefore, may be assured when his flax appears in any degree branched, that too small a quantity of seed has been used, and that an inferior sample will be the certain result. No doubt can be entertained that a sufficient quantity of seed has not been generally used in the cultivation of this crop. About three bushels, or nine pecks, to the statute acre, will be the proper quantity ; and if fibre of an extraordinary degree of fineness be required, another gallon or two should be added. This is a close approximation to the quantity used in the most celebrated flax-growing districts on the continent.

It is, perhaps, almost unnecessary to mention that the flax-grower should ascertain that the seed he employs is of good quality, and free from any admixture of the seeds of weeds. Great circumspection is, however, required on these points, as large quantities are annually imported for sowing altogether unfit for that purpose, and

the importation of which would not be attempted, were it not that what remains on hand after the seed-time is over can be advantageously disposed of to the oil-merchants.

The greatest pest to which the plant is subject is the dodder, and your prospects of a crop depend upon obtaining seed entirely free from the seed of this most destructive parasitic weed. To this end you must procure seed either from a grower whose crops were free from it, or from a dealer who may be trusted.

Dodder* is propagated by seed like other flowering plants, but it has a peculiar appearance from its pinkish or yellowish fleshy stems, resembling wet catgut, which run over and twine round everything in their neighbourhood; from the total absence of leaves or decidedly green organs in every stage of growth, and the little globular heads of wax-like flowers. The seed may easily be collected in autumn, and the intelligent farmer will find it an interesting matter to watch their growth if sowed in a common flower-pot in spring. The seeds soon germinate, sending up a long straight thread without a trace of leaves. This gradually elongates, and if there is nothing present to which it can become attached it soon perishes. If, however, any plant which it attacks be sown with the dodder seed, a curious change takes place. The young threads, unable to support themselves, fall and come in contact with the plant in question; a little wart is formed on them at the point of contact, which is gradually firmly attached and then becomes incorporated with the underlying tissues to such an extent that it is able to imbibe their juices; and as soon as this connexion is established, the threads die off below, all communication between them and the soil is cut off, and the dodder, which twines from left to right, lives like a true parasite at the expense of the plant to which it has become attached. The growth is then extremely rapid, and the plant has such powers of life that the smallest bit which is broken off, should it fall on a plant capable of giving its nourishment, flourishes and forms a new patch.

"On no account," says Professor Buckman, our chief authority on the weeds of the farm, "should flax be sown from an infected field. Farmers who are willing to buy dirty seed are usually of that class who believe that weeds don't come from seed, but are the natural and spontaneous generation of the soil. Dodder seeds are less in size than either clover or flax seeds, but they are more easily separated from the latter than the former because the difference is greater; still, in a sample of flax which has lately come before our observation, we detected no less than 100 seeds of the dodder in a pint, a quantity quite sufficient to occupy the soil, so that its presence is a matter not difficult to understand if a crop infested with

* Rev. M. J. Berkeley, in the "Agricultural Gazette,"

the parasite be not cleaned; for on a single plant of flax now before us we make out the sum of twenty-eight clusters of capsules of dodder seed having an average of seven capsules to a cluster, each of two seeds ($28 \times 7 \times 2 = 392$); and as the same plant produced only 315 of its own seeds, we see that the parasite produces seed more prolifically than the plant upon which it feeds.

"The presence of dodder in flax seed may easily be determined by any one who has ever examined separate seeds of the parasite, but such as have not will perhaps find it easier to separate every foreign kind of seed from the flax or lint seed. Place a few of the suspected seeds in some moist soil in a hothouse or any warm corner, and the thread-like plants will peep up in two or three days, and will soon attach themselves to any of the flax plants which may come up at the same time.

"That looking into seeds or crops in the manner indicated presupposes that some care and trouble is to be expended on this subject is quite true, still the importance of the matter renders it worthy of any amount of time and observation, and the intelligent agriculturist should moreover be desirous of acquiring information upon such valuable points connected with his profession, not merely from this cause, but because it is education and knowledge which distinguish a man from his fellows."

VI.—GREEN CROP CULTIVATION.

April is a very busy month in green crop culture. Potato planting should be finished as soon as possible. Carrots should be sown. Mangold wurzel seed should be sown or dibbled; land should be prepared for turnips. Kohl rabi and cabbage may be sown in seed beds for a later transplanting.

Potato planting should be finished as rapidly as possible. The process was described last month. On the following page are given drawings to a common scale of some of the best known sorts. These sketches have been taken from specimens in the collection of Messrs. Lawson, of Edinburgh, to which I have been kindly allowed access. It is only proper to add that the names are of very doubtful authority, as indeed any names would be, seeing that the same sort is continually reappearing under different names; and is known under different names in different parts of the country.

The following, however, are the names given to me in connexion with the drawings:—

1. Mangold. 2. Shaw's Early. 3. Connaught Cup. 4. Early Windsor. 5. Stafford Hall. 6. Dodd's Seedling. 7. Old Flat White (or Lapstone). 8. Regent. 9. Cups. 10. Irish Lumper. 11. Robertson's Giant Kidney. 12. Chapman's New Spring Potato.

Of these the great majority of acres in this country are devoted to the growth of No. 8, and modifications of it. No. 7, known now

Fig. 29.

1



2



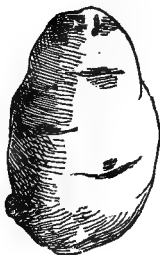
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4



5



6



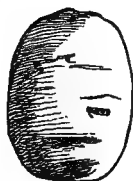
7



8



9



11



10



12



as the Lapstone kidney, is also a common sort. Other flat potatoes, as the Fluke—a late and prolific sort—are coming rapidly into favour. Soden's early Oxford—a white round, resembling No. 6, early, prolific, and of good quality—is in some quarters deservedly a favourite. And there are many kidney potatoes, early and late, also favourites in other quarters. The Axbridge kidney—a somewhat late, dark leaved, white flowered potato, of a tapering kidney shape, white, but becoming purple on exposure—is a valuable kind, much cultivated near Bristol. Nos. 9 and 10 upon the list of figures have a great reputation for abundant yield and fair quality in Ireland. Experiments illustrative of the quality of other sorts, "Dalmahoy," "Protestant," &c., both of them varieties of Regent, are described at page 158.

The earlier planted potatoes will be pushing through towards the end of April. It is well to cover them up by a light ridging with the double mouldboard plough if they appear in any quantity early in the season; as they will otherwise probably be cut off by the frost. As soon, however, as they are in any degree safe from that risk, the ground should be well stirred between the rows by a horsehoe, and between the plants by a deep hand-hoeing, by which at the same time the weeds are all cut down; and next month the rows are finally earthed up by the double mouldboard plough.

The carrot, and especially the Belgian variety of it, yields a very large produce of capital food for cattle.

In the last volume of the "Journal of the Royal Agricultural Society of England," Mr. Blundell, of Bursledon, near Southampton, says that he has grown after a bare fallow on a sandy loam, about twenty-five tons per acre of large roots, besides fourteen tons of thinnings, and seven tons per acre of tops: the seed having been sown on the 14th of May, in rows sixteen inches apart, and two cwt. per acre of superphosphate, and twenty-five bushels of ashes, having been sown with the seed. The crop was harvested by being forked out of the ground, topped, and carried to heaps, and covered with earth in the month of November. There is no better food for horses and milch kine. Sheep and all other live stock feed greedily on carrots.

April is more properly its seed time than the month of May, though no advantage is obtained in cold spring weather by sowing it too soon. When sown early in this month, it often lies unsprouted for a long time in the soil, and in the meantime weeds grow and cover the surface of the land, often to the destruction of the young carrot plants when they do appear. It is well, therefore, to sow along with carrots a few grains of barley or oats, which, springing up, will mark the future row, and so enable an earlier hoeing of the ground.

Carrots come in the rotation after a corn crop. The corn stubble

should have been cleaned, well tilled, and manured in the autumn; and if stirred by the grubber pretty early in spring, and harrowed down and well rolled this month, it will be ready for the seed. Sometimes, however, carrots are taken after a turnip crop fed off by sheep; and there is no better chance of obtaining a good crop. The turnips should have been consumed early in the spring, and the land ploughed and well harrowed, and that is all the preparation it will need. About six lbs. of seed should be procured for every acre; and it is well to mix them for a few days with damp sand, and then add a peck of oats to the quantity of sand holding six lbs. of carrot seed. The whole may be sown on well rolled land with the Suffolk drill, in rows about fifteen inches apart: the weights being taken off the coulter levers to ensure that the seed shall not be deeply covered.

It may be well, beside the autumnal manuring in the one case, and the sheepfold in the other, to sow broadcast a week or two before the seed two or three cwts. of Peruvian guano if a great crop is desired. The seed is covered in either by the roller, if the weather be dry, or by the bush harrow, and the field shut up till the appearance of weeds indicates need of the hoe; when either the hand or the corn horse-hoe must be set to work, which can be safely done, as the rows of the corn sown at the same time, show the place of the future rows of the carrots to be saved.

The Belgian carrot is much the best kind to sow for cattle food; it will yield from six to sixteen tons per acre more than any of the red garden carrots; and the value of the two per ton as food is not materially different. Twelve to fifteen tons per acre of the Belgian carrot may be expected under good cultivation; and twenty-five to thirty tons have not unfrequently been realized.

The mangold wurzel* is the crop on which we have latterly in chief depended as the substitute for our failing turnip crop. Yielding with greater certainty a much heavier produce of food as good as the turnip, no wonder that it is rapidly growing in favour. It has always been known as keeping good till late in the following season; but, till of late, it has laboured under the stigma of being so excessively relaxing when fed early in the season, as to be more injurious than nutritious until the spring; and even then we have heard of its causing abortion in swine, sheep, and cows, so that it was only under special circumstances that it could be chosen by the cultivator as his main green crop. In 1859, however, we had a frost upon our green crops, which killed them down, and forced their consumption before winter, if it was desired to save them at all; and it was found that even the frosted mangolds spread in the pastures and in the yards did ewes in lamb and swine in farrow no

* Sutton's "Farmer's Manual, 1861."

harm whatever. And last year (1860), when, owing to the coldness of the season, the mangold wurzel crop has been a comparative failure, it has been a common practice to fold sheep on them early in the autumn, leaving Swedes for that later period of feeding for which the mangold wurzel had hitherto been deemed especially adapted; and it is found, especially where the root is pulped and mixed in varying proportions with chaff of hay or straw, that no relaxed state of the bowels has, under good management, followed the large and early use of the crop. It is still, however, as the root crop of the summer months that the mangold wurzel possesses an especial value. So good a keeper is it, that stock might indeed be kept on it all the year round; for there is no better food for pigs and cattle generally in June, July, and August following the year of its growth. Any season like the past, therefore, which by its unusual coldness has proved less adapted to the growth of this crop than any we have had for years, is, in its effect on our supplies of cattle food, no less than a national calamity. A crop which in ordinary seasons produces thirty to forty tons per acre, has during the past year in many cases failed to produce fifteen; and that on which we generally depend for late spring food, was in many cases fed in autumn by sheep on the fields of its growth.

The cultivation of the mangold wurzel is precisely the same as that of the Swedish turnip, to which we shall refer in detail next month. There is a difference in the seed time, but hardly any in the treatment of the soil, either before it, or during the growth of the crop. Mangolds like a stiffer soil than turnips; but there is the same need of an industrious and forward autumnal cultivation of the land. If the plough is used in spring, it will on clay soils turn up a cloddy surface which is difficult to reduce, and which is a hindrance to the proper cultivation of the crop. If the land be ploughed and cleaned, and manured in rows during the autumn, then it only needs the same spring treatment of the drilled land which has been described in the case of Kohl Rabi (p. 160). A heavy dressing of dung, and a liberal supply of superphosphate, will be well repaid in the future crop, and it is found, in accordance with what is known both of the natural history and the chemistry of the plant (*viz.*, that it is a native of the seashore, and that its ash contains a large proportion of chloride of sodium, or common salt), that the crop will also repay, by additional and more healthy growth, a considerable dressing of common salt, to the extent, indeed, of two or three cwt. per acre.

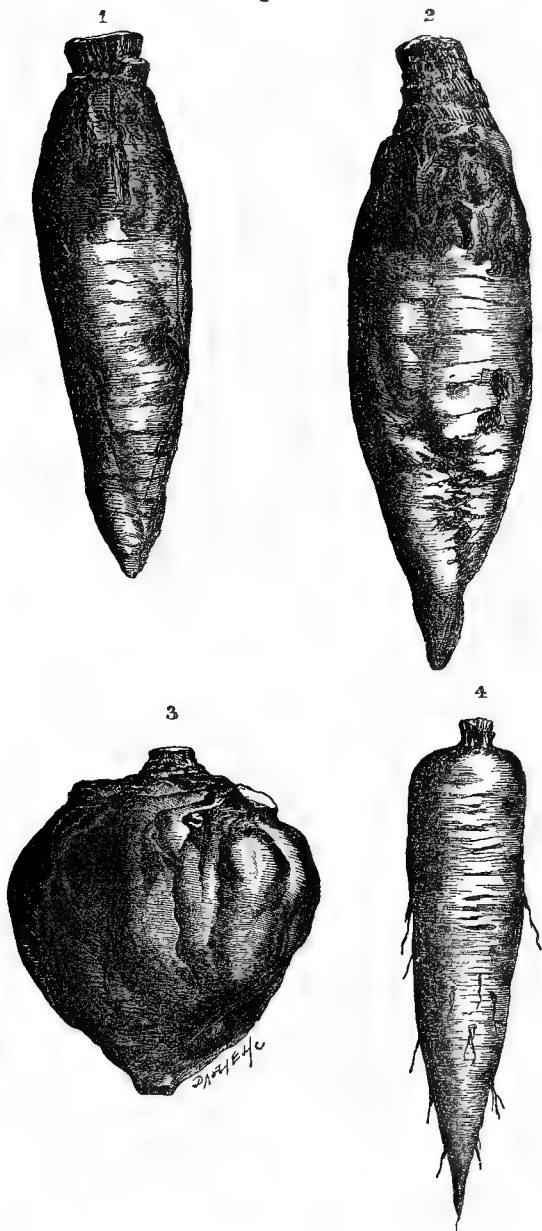
The seed may be either drilled on the top of each drill or row, or dibbled therein at intervals of fifteen to eighteen inches—the rows themselves being twenty-eight to thirty inches apart. The proper seed time is about the end of April. No advantage is obtained by sowing too early, as the seed will be longer in the land without ger-

mination, and the plants will also be more liable to run to seed. From six to seven lbs. per acre should be used ; and if it be damped for two or three days before sowing, it will sprout the sooner. The cheapest way to sow it is by the drill, depositing two rows or more at once, either on the flat, or what is better, on the top of the ridgelet over the row of manure ; but it is not much more costly, and there are some advantages in depositing the seed by the hand dibble. The women or boys who plant the seed have a stick the length of the interval between the future bunches, and they measure out the place of the next plant by means of it. With the end of it they remove any clod which may lie there, making a little bed for the two or three seeds which they drop in that place, and then covering them up with a little fine earth, and half treading them in.

Mangold seed is very easily buried, and not more than half an inch of earth should be used to cover it. The plants come up in bunches in these places. The intervals between the rows are horse-hoed, those between the bunches are hand-hoed, and the bunches themselves are pulled to single plants as soon as the leaf is the size of a child's hand ; and the cultivation during the summer, by horse-hoeing and hand-hoeing if necessary, is continued as long as the leaves do not cover the ground. This, however, is work for June and July, when it will be referred to again.

The varieties of mangold wurzels include distinctions of shape and of colour. The globe-shaped are best for several reasons, one of which is that the globular form presents least outside in proportion to its quantity of contents, and so there is less exposure to frost or drought, and less liability to injury either during winter or the following summer. And as to the former, there is this special advantage of the globular over the long and tankard mangolds, that the former grow upright, and are thus sheltered against the early frosts under a canopy of foliage, while the long-shaped roots straggle over the surface of the ground, and are thus exposed in every direction to the sky, and the consequent frost of a clear autumnal night. This is no mere speculation, but was verified in the experience of many during October, 1859. The globe red and orange mangolds are therefore to be preferred to the long reds and long yellows, notwithstanding that the latter might have been expected to yield the larger produce per acre. The greater facility, too, of removal from the ground, which one would expect in the long mangolds, from the greater hold which their shape enables to be taken of them, is in practice not obtained. The globe has this year, 1860-61, in our experience, pulled more easily than others which have had long and forked roots, giving them so much greater hold of the ground on which they grew. There are, however, many different sorts both of long and of globe mangolds, which have been selected for seed with varying degrees of care for various periods of time, and so exhibit

Fig. 30.



in their produce various degrees of excellence and constancy to the type of the best specimens of each.

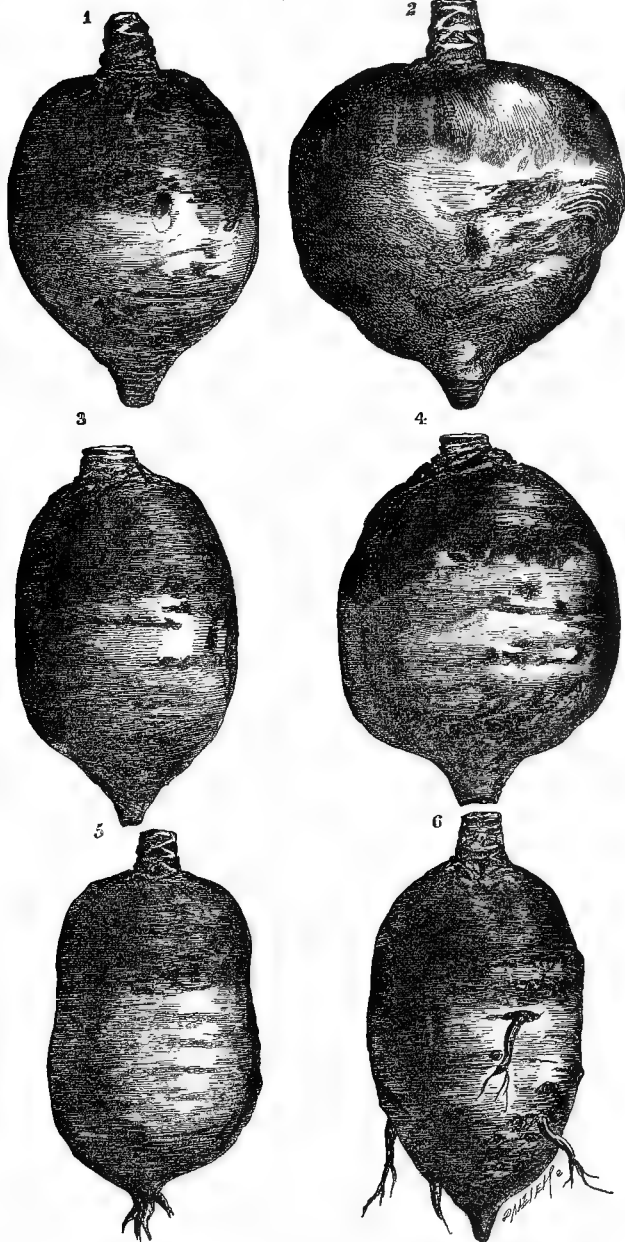
The four sorts figured, from Messrs. Lawson's specimens, in the opposite page are—1, the Elvetham long red; 2, the common long red; 3, the globe; and 4, the Silesian. The third is unquestionably the best, on the grounds already stated; the fourth, a white long wurzel, is considered richer in saccharine matter than the others.

Turnip culture will occupy us in the months of May and June; it must suffice at present to say, that land intended for turnips should have its cultivation completed as early as possible in the spring. As the summer approaches, with hot suns at intervals, any degree of poaching, or daubing, or trampling becomes more and more fatal, for the sun binds whatever earth was touched in too wet a state. And if the ploughing, especially of clay soils, be done late in this month or in May, it is very difficult to obtain the tilth which the small turnip seed requires. The best possible arrangement is that which fallows, manures, and ploughs land for turnips in the autumn, leaving the spring cultivation to be accomplished by implements of the grubber and scarifier class. It will be better, however, to postpone a detailed account of turnip culture until next month, when the attention is almost wholly engrossed by this subject; and it must suffice to add here, that if any preparation, whether of home manure or of purchased manure for the turnip crop, is still incomplete, it ought to be set about at once. Any manure which may still remain in the yards, intended for the turnip fields, should be carried out forthwith and laid lightly together, to facilitate the rotting process, and get it as quickly as possible into the condition fit for placing in the turnip drills. The purchase of seeds, too, should be completed; three pounds of the sorts intended to be sown for every acre of each which it is intended to grow, should be purchased. And as the selection of sorts should be guided by a knowledge of their character, we give, in the following pages, drawings of six different kinds of Swedish turnips and hybrids, and of six different common turnips, taken, as in the case of the potatoes and the mangold wurzels, from the collections of Messrs. Lawson of Edinburgh. In Fig. 31, No. 1 represents the common Lothian Swedish turnip; No. 2, the common green-top Swede; No. 3, Woolton's hybrid; No. 4, Laing's Swede; No. 5, Dale's hybrid; No. 6, Skirving's purple-top Swede.

Of these, the last-named is a well-known large and productive variety of old standing, characterized by a rather coarse neck and tendency to general coarseness of growth, including, however, the valuable property of size and weight.

Of Dale's hybrid, the following description is given by Mr. Lawson in his *Agriculturist's Manual*. It is a hybrid between the common and Swedish turnip, resembling the former more than the

Fig. 31.



latter in the character of its leaf, and also in the structure of its root:—"It has received the name of Dale's Hybrid, from being first raised and brought into notice by Mr. Robert Dale, an intelligent farmer at Libberton West Mains, near Edinburgh, who having, in 1822 or 1823, received a few ounces of seed of a new hybrid variety of turnip from the late James Shirreff, Esq., of Bastleridge, Berwickshire, sowed the same; the produce he found very much to resemble the Swedish in shape, and from which, by repeated selection and impregnation, he at length obtained this esteemed variety, the distinguishing characteristics of which are—foliage strong and luxuriant; roots of a large size, oblong shape, and of a lightish yellow colour, with light green top, having also a small neck and tap-root. The shape of the root, however, although generally oblong, is rather apt to vary, being sometimes almost globular, but its more material characteristics of large size and luxuriance of growth are uniformly the same. Compared with any other of the common yellow field sorts, it is found to arrive sooner at maturity, and consequently may be sown at a later period of the season; while at the same time it is equally hardy, or at least has been found sufficiently so to withstand the severest winters which have occurred since its introduction."

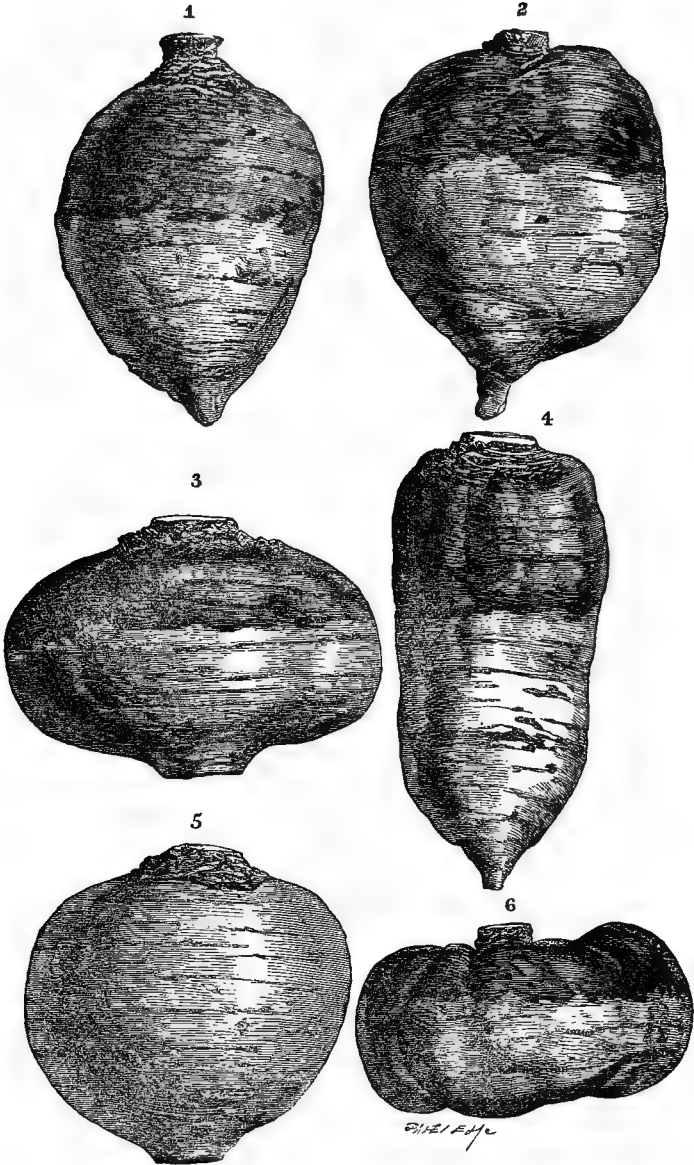
The fourth sort figured in our page is Laing's Swede, recognisable by its entire leaves, which extend unbroken down to their junction with the head of the root, and by the shortness of the neck, the neatness of the bulb, and its smaller liability to run to seed. It is not, however, a very large cropper. Woolton hybrid, No. 3 upon our list, originated in a field of Swedish turnips near Hull, and partakes, with Dale's hybrid, of the character of the common turnip; it is a red-topped white turnip of large size, hardy, and keeping well late on in the spring. Nos. 1 and 2 upon the list represent the commoner sorts of Swedes grown in the best cultivated districts of Scotland. Besides those thus named, many others are in use; and all our best seedsmen introduce varieties of their own, and endeavour to ensure the permanence and value of their qualities by careful selection of roots for the growth of seed. Skirving's, Laing's, and Nos. 1 and 2 in Fig. 31, may be taken as specimens of the largest, neatest, and more usual varieties in cultivation; and Nos. 3 and 5 again represent a now numerous class of hybrids.

On page 232 we have drawings of six varieties of common turnip, for which we are again indebted to Mr. Lawson. They are respectively (1) the ox-heart, (2) the grey stone, (3) the Norfolk, (4) the tankard, (5) the common round, and (6) the Hungarian flat turnip.

The following may be taken as descriptive of these sorts:—

The ox-heart turnip (1) is roundish or somewhat heart-shaped, being

Fig. 32.



tapered on the under side, white below and green above, possessed of considerable solidity and firmness of texture.

The grey stone turnip (2) has come of late into general favour as a very productive and hardy sort—globular, and firm in texture.

The Norfolk turnips (3) are thus described by Mr. Lawson :—They are all of a peculiar flattish shape, rather hollowed towards their neck, as also on their under side, and when grown to a large size they become more or less of an irregular round or somewhat cornered shape.

The Green Top variety possesses these characters in a less degree ; and is generally of a pretty regular round shape, flattened, but not much hollowed on the upper and under surface ; the former of which is of a green colour and the latter white.

The tankard turnip (4) is of various colours. In the green tankard the roots are more than half above ground ; oblong shaped ; of a greenish colour, except on the under surface, which is white. The tankards, like the Norfolks, are unsuitable for winter feeding, not so much on account of their softness as from their standing mostly above ground, and being thereby much exposed to frost. They are also generally earlier in arriving at maturity than the others. In the white tankard the root is longer, and in general larger, also softer in texture than those of the green tankard ; often bent or crooked ; leaves large and luxuriant ; the earliest maturing of any, but will not stand the frost. The red tankard, in size, shape, and texture, may be considered as occupying an intermediate place between the green and white tankard. It is of a bright red colour on the upper surface, and white on the under.

In the common round turnip, No. 5, Fig. 32, the roots are globular ; skin smooth and perfectly white ; neck and tap-root small. Although the above description embraces the principal characters of the white globe turnip, yet there is a considerable variety in sorts to which this name is applied, arising from the degree of care and attention bestowed by growers in selecting their seed roots ; and the shape is often not a little affected by the kind and state of the soil in which they are grown. Thus globes of any kind, and particularly the variety here mentioned, when grown on a very superior rich soil, may be said to be forced beyond their natural size, and thereby acquire somewhat of a monstrous or overgrown appearance, losing in a great measure their natural symmetry of shape.

The Hungarian turnip is, according to Mr. Lawson, a very distinct variety, having entire and erect growing leaves ; its roots are of a roundish or somewhat flattened shape, attain to a medium size, and arrive early at maturity. In a collection of turnips, the seeds of which were received from France in 1837, and grown in the experimental ground of his Grace the Duke of Buccleuch, at Dalkeith Park, this appeared the most promising ; but it has hitherto

received little attention from British cultivators, although with care in the selection and rearing of its seed, it might be found a superior sort.

This must suffice for the present on the sorts of turnips and Swedes which may be selected for cultivation. In illustration of the number of kinds now cultivated, I may add, that at the last exhibition of the Smithfield Club (1860), Messrs. Lawson's stand of roots was signalized by a collection of no fewer than eighty-seven different kinds of the turnip, three or four roots being shown of each kind. Among them was the Tweeddale turnip, which by continued selection and careful growth under the superintendence of the Marquis of Tweeddale, has been year by year increasing in density, until, now heavier than water, it has acquired the specific gravity of 108. Of course, the choice of sorts and the quantity of each must be determined by the stock to be fed during the different winter months, and the provision of food necessary in autumn, winter, and spring respectively. The common turnips in our southern counties, at any rate, should be consumed by January, and the Swedes by March or April, leaving for the later spring and early summer annually a store enough of mangold wurzel.

Cabbage and Kohl Rabi.—An additional seeding of the Drum-head cabbage, and of the purple or green kohl rabi may be made this month over a perch or two of seed-bed, so as to suffice for a later acre or two of the crop. It is, however, rarely that a late sown crop of the latter is of much service except for its leaf. And in the month of April unquestionably the best use of land then to be sown with green crop is for Belgian carrot and mangold wurzel; while in May, mangold wurzel in the early part of the month, and Swedish turnips in the latter part, are the best crops to sow.

Cabbages.—April, however, is the season for planting the crop of autumn-sown cabbages. It is a work extremely easy to perform, and not at all expensive. If the land is well tilled and manured, drill thirty-six inches wide or thereabouts. These ridges are to be lightly harrowed, and one row of plants set along each ridge.

Women or boys should lead the way with the plants, and drop them, as nearly as they can, where they are to be planted; then the men follow with dibbles, and set them. The work goes on quickly, and is not expensive. It may indeed be contracted for at 20s. to 25s. an acre for plants and planting. Or cabbage-seed may be drilled in April, where they are to remain. This system precludes the necessity of transplanting, which is at all seasons attended with some uncertainty, and in summer can only be performed in, or immediately after rain, and in case of a drought must be postponed till a good crop may be unattainable. They should, in the drill system, follow some hoeing or cleansing crop, such as turnips, a previous crop of potatoes, beans, or peas, &c. I suppose the land, in the case of its having

yielded turnip, to have been ploughed the moment the produce was consumed, into such ridges as are intended for the cabbage-seed, either three or four feet wide. If any of the other crops preceded, this ploughing should have been given before the Christmas frosts. Into the furrows of these ridges the dung, thirty cubic yards an acre, in no case less than twenty, should be laid in March, and the ridges reversed directly, covering up the manure and forming new ridges. They then should be left for ten, twelve, or sixteen days to the influence of the atmosphere. In that state they lie sound, even though soaked with rain. When it is intended to drill, harrowing should precede, or it may be omitted if the soil is very friable and in fine order, as the roller to which the drill is attached will level the crowns sufficiently, and they should not be reduced too much. The process of sowing is similar to that of turnip sowing, which will be described next month.

VII.—LUCERNE.

This crop is not commonly cultivated on large farms. It is more generally liked by tenants of small occupations, and probably more by amateurs than practical farmers. This, however, is because it is especially useful where a single horse or two, or a cow or two are kept. For the provision of such times, as, for instance, when haymaking is delayed, and cattle are waiting for the aftermath, their own pastures running short, or even in early spring, for it is early and quick growing, lucerne is a useful plant. It flourishes on deep calcareous loams, which should be well manured and deeply tilled in autumn. And in the middle of this month fourteen to sixteen lbs. of the seed may be sown in shallow drills about a foot apart. It requires a mild climate, a sheltered spot, and a good deep soil, and if all these are to be found near the farm buildings, the crop will yield very useful forage for the stable and the cow-house during summer. In the former editions of this book, Arthur Young speaks of the crop under several heads. 1. Of the utility of the crop, which should induce a young farmer to enter freely on the culture. 2. The soil to be chosen. 3. The preparation. 4. The mode of sowing. 5. The quantity of seed. 6. With or without corn.

1. The crop is an object of such consequence to those who have a proper soil for it, that its value does not admit of doubt: but, if a beginner in husbandry has apprehensions, let him mount his horse, and travel near the coast of the Thames and sea, from Dartford to the limits of Hampshire, and he will hear of lucerne all the way, and see much of it. The principal, and probably the best use to which it can be applied, is that of soiling all the horses on the farm; next, of soiling cows, young cattle, and fattening beasts, soiling hogs, and, lastly, making hay. These are objects of such conse-

quence, that they ought to be provided for ; the last, however, proportion to the meadow-grounds of a farm, and to the sainfoin which may be on it. Where these abound, lucerne for hay is the less necessary. The importance of a general system of soiling can never be impressed too frequently. The repetition and influence of the benefit pervades every crop on the farm. Inasmuch as dung is so important, this practice is so. Dung, without it, is made during half the year ; with it, through the whole, and he only who knows the immense consequence of raising dung, can duly appreciate the necessity of soiling.

2. The soils that suit lucerne are all those that are at once deep and rich. If they possess these two qualities, there is no fear but they will produce large crops of lucerne. A friable deep sandy loam on a chalk or white dry marly bottom, is excellent for it. Deep putrid sands, warp on a dry basis, good sandy loam on chalk or marl or gravel, all do well ; and, in a word, all soils that are good enough for wheat, and dry enough for turnips to be fed on the land, do well for lucerne. If deficient in fertility, this circumstance may be compensated by draining, manuring, but I never yet met with any land too rich for the plant.

3. The best preparation for this, as for all other grasses, is two successive crops of turnip or cabbage, both fed on the land, and the last before the sharp frosts are over. This management frees from all weeds better than any other, and at the same time greatly enriches. Upon land previously clean, one of these crops may do well enough ; but let no farmer ever venture lucerne upon land that by some method, whatever it may be, is not rendered quite clean.

4. In regard to the mode of sowing, the greatest success is declared to have been by the broad-cast method, which is nearly universal among the best lucerne farmers, even among men who admire and practise the drill husbandry in many other articles. But as the farmers mostly (not all) depend on severe harrowing, for keeping their crop clean, which is a troublesome and expensive operation, I shall venture to recommend drilling, but very different drilling from that which has been almost universally practised, viz., at distances of eighteen inches or two feet. Objections to these wide intervals are numerous. If kept clean hoed, the lucerne licks up so much dirt, being beaten to the earth by rain, &c., that it is unwholesome, and the plants spread so into these spaces, that it must be *reaped*, which is a great and useless expense. For these reasons, as well as for the superiority of crop, I recommend drilling at nine inches, which, in point of produce, mowing, and freedom from dirt, is the same as broad-cast ; and another advantage is, that it admits a scarifying, once a year, which is much more powerful and effective than any harrowing. The facts are sufficient to weigh so much with any reasonable man, as to induce him to adopt this mode of drilling, a nearer to broad-cast by far than it is to drills at eighteen or twenty

four inches, which open to a quite different system, and a set of very different evils. Nine-inch rows might, *practically*, but not literally, be considered as broad-cast, but with the power of scarifying.

5. In regard to seed for nine-inch drilling, fifteen lbs. is to be recommended.

6. The material point of—with or without corn, remains to be spoken of; and here two considerations present themselves. One is, the extreme liability of lucerne to be eaten by the fly, which does great mischief to many crops when very young, and against which the growing corn is some protection. The value of the barley or oats is another object, and not to be forgotten. It is also gained in the first year's growth of the lucerne, which is very poorly productive, even if no corn be sown, so that I must own myself clearly an advocate for drilling it among corn, either between the rows of nine-inch barley, or across drilled barley at a foot; perhaps the last is the best method, as there is less probability of the crop being laid, to the damage of the lucerne. The quantity of seed-corn should also be small, proportioned to the richness of the land; from one bushel to a bushel and a half, according to the fertility of the soil; another security against the mischief of *lodging*. If these precautions are taken, it would be presumptuous to say that success must follow, *that* being always, and in all things, in other hands than ours; seed may prove bad, the fly may eat, and drought prevent vegetation, but, barring such circumstances, the young farmer may rest satisfied that he has done what can be done; and if he do succeed, the advantage will be unquestionable.

Sainfoin.—There are parts of this kingdom in which the farmers could not pay their rents without the use of this crop. It has been already referred to in previous months. On dry limestones and chalky soils it will thrive to extraordinary profit. It may be safely sown in April. The land should be clean, and free from weeds and the seeds of weeds; and this is the principal circumstance to be attended to. It should be sown with barley or oats, the land in fine tilth, and the seed covered by harrowing when the land is dry. It may also be drilled as in March. Upon the soils proper for it, no man can sow too much of it; for no other use of the land will pay better. It will, on poor soils, often yield a ton and a half, and even two tons and a half of hay, or a ton at the least, at one mowing per acre, and afford a considerable after-grass besides. The products and profit of such land in tillage, or in a sheep-walk, are quite inconsiderable, compared to what sainfoin yields. The proper quantity of seed is four bushels (rough seed) per acre. It flourishes so well broadcast, that there is no *necessity* to attempt it in the drill method. I have seen it cultivated, however, with great success, drilled at nine inches across drilled barley.

It is well to be careful in selecting this, as well as other seeds, to be sure that you have it pure. Burnet grows commonly in sainfoin

fields, and few samples of sainfoin seed accordingly are from it.

Vetches.—Whatever spring vetches it may be intended to put in may be sown this month. Three bushels per acre may be drilled on any stiff soil that has been manured and cultivated for this purpose. The crop will probably be fit for folding or for forage in July and August, and will be off in time for a partial fallow before the succeeding crop of wheat.

Rye will now be available for folding sheep, and for forage to supply the stable and the feeding stall, and towards the end of this month trifolium incarnatum and the yellow hop trefoil will also be useful for all these purposes.

Grass Lands.—All works of preparation for the hay crop should have been completed early in this month. After all stone picking and other work of clearance has been done, the land should be rolled, to level it for the scythe. The roller must be of weight enough to level worm-casts and crush mould.

Watered Meadows.—Throughout this month, if there are watered meadows on a farm, the use of them in supporting ewes and lambs is exceedingly great; but the fold should not be continued into May, or it will greatly injure the quality of the succeeding crop of hay. Not, however, that there is any positive rule in feeding, as is evident from a case cited in a former edition:—“Having heard that the proprietor of an old flooded meadow at South Cerney had disposed of the produce of it, in the year 1795, in a way that was well calculated to ascertain its real value, I wrote to a person who resides on the spot, requesting him to send me a particular account of the product, and I received the following statement. In order to make the most of the spring feed, the proprietor kept the grass untouched till the 2nd day of April, from which time he let it to the neighbouring farmers to be eaten off in five weeks (which ran a week into May) by the undermentioned stock, at the following rates per head: a sheep, 10*d.* per week, a cow, 3*s.* 6*d.*; a colt, 4*s.* The quantity of the land is eight acres.

107 wether sheep, one week.	£4	9	2
8 cows, ditto	1	8	0
4 colts, ditto	0	16	0
	6	13	2
			5
For five weeks	33	5	10
Three colts added for three weeks	1	16	0
	8)35	1	10
Per acre	£4	7	8

The hay crop was, as usual, about 15 tons, and was five weeks in growing.

	£35	1	10
15 tons, suppose at 50s. . .	37	10	0
After grass 15s. per acre . .	6	0	0
	8)78	11	10
Total per acre . . .	£9	16	5

“The 4l. 7s. 8d. was made at a time when other grass-land is in a dormant state, or exhibits but feeble symptoms of vegetation. But the reader will perhaps see the advantages of this art in a still stronger light, when he is told that this meadow, which is now in the occupation of a miller, was a few years ago in the hands of a farmer, who, being at variance with the miller, was entirely deprived of the use of the water for a whole winter, which unfortunately was succeeded by a very dry spring and summer; of course, the spring feed was lost, and the whole hay crop of eight acres was only three tons.”

In general the folding with sheep commences in the end of March, and is completed early in April. From November to March the water is turned upon the meadows as often as possible (generally four days in six); they are then laid dry for sheep, which are turned in about the middle of March, and feed off successively one meadow after another, being a week or a fortnight in each, and as they are removed the meadow is laid in for grass, and put under water two days on two or three successive weeks. The crop of hay is cut in the middle of June—the meadows coming in succession as they were fed—after which they are usually watered once and fed with dairy cows until November. They thus have three crops per annum. The first is fed off, the special benefits of this being that it is ready when nothing else affords a bite, and that in good meadows it affords a bite for 1000 couples per acre per day! The crop of hay averages one and a half ton, and the feed for the cows subsequently is most excellent and abundant, yielding a large supply of butter of a greater value than that made from the milk of dry meadow-ground fed cows.

The application of water meadows to dairy purposes obtains to a very large extent in the neighbourhood of Salisbury. There are, indeed, large areas specially applied to this purpose. In the meadows surrounding Salisbury, the cows, if they have calved, are turned into the meadows about the last week in March, or first week in April—at first, for a few hours at a time only. The grass produces a plentiful supply of milk, but it is necessary that cows should have some hay at night to counteract the otherwise too purgative effect of the grass. During the feeding of the meadows by

cows, butter and the fattening of calves are the staple productions ; as the season advances, however, good cheese is manufactured from them. If there is insufficient dry pasture to take the dairy cows during the growth of the hay crop on the meadow, one of the meadows is alternately fed instead of being mowed. It is, in this neighbourhood, unusual for meadows to be mowed more than once in the year, and for the most part the grass, after the hay-crop, is consumed by cows and horses—a course generally considered compulsory, in consequence of the almost certain production of the rot, or flake, in the liver of sheep fed in any water-meadow after Midsummer. The value of the meadows in relation to arable land would be much increased if this result could in any way be mitigated or avoided.

The Hop Farm.—In the hop-grounds the process of poling continues ; and as fast as each garden is finished the ground is hoed over, the principle being to destroy all weeds in their earliest stage, and never to allow them to grow at all, if we can help it. Some of the labourers may have been engaged in cutting larch hop-poles ; the teams have been engaged in carting hop-poles to the grounds, and in labours connected with other parts of the farm cultivation.

It may be well to try a few acres of horizontal poling by way of experiment : a considerable increase of crop has sometimes been obtained by this means.

Hedging.—This month must conclude the business of fences. It is bad husbandry to cut any hedges after April. They will not be so sure of growing ; and nothing but an uncommonly late season should permit anything of that kind to be done now. All the faggot-wood arising from hedges should be brought home immediately.

VIII.—THE LIVE STOCK.

The dairy is becoming of more important interest as the year advances.

Gloucester Cheese.—The following passage is from the pen of of a Gloucestershire dairywoman, and is taken from the *Agricultural Gazette* of 1856 :—

The process of cheesemaking commences very generally in the beginning of April, although that which is made whilst the cows are eating hay is never of the finest quality. This is very manifest even in the outward appearance, there being a deficiency of the blue coat, a sign of richness which is observable when the cows are eating grass ; and the cheese is more inclined to heave during this month than later in the season.

The use of a small quantity of the sour whey, as already named

(p. 174), and also a little saltpetre, has sometimes proved an effectual remedy against this. A tablespoonful of saltpetre to about forty gallons of milk is placed on the cloth which covers the cheese-tub underneath the sieve, and the milk passed through in straining dissolves it, and mixes it effectually with the milk. The practice of using annatto or cheese-colouring is not so generally adopted now as formerly.

After the rennet is put into the milk it should always stand at least an hour without being disturbed, when it should be cut slowly with a knife having three blades, but only sufficiently small to allow of some of the whey being dipped from it; after it has stood a quarter of an hour it may be broken up very small, without the risk of getting the fat from the curd into the whey, which is of importance; the curd being broken very small the second time causes it to sink into a solid mass, and the whey can then be more easily taken from it. It is of importance that the curd be made as dry as possible; therefore it is generally put into vats and placed in the press for half an hour to effect this, and when taken out and placed in the tub, in large dairies, a mill for grinding the curd placed on the top of the tub has been found efficacious, as a saving of much labour to the dairymaid, the crumbling of the curd sufficiently small being a very hard process for the hands, and not so regularly done as when prepared by the mill. It then only requires to be pressed firmly into the vats. Cheese has been found richer by the curd not being regularly scalded, but merely a little scalding water thrown over it after the vat is sufficiently full, first laying a cloth over it, the cheese being turned over to allow of both sides receiving the hot water; this makes it firm on the outside and prevents its cracking.

It is well to commence cheesemaking by using the thinnest vats; the cheeses in these are more likely to keep their proper shape thus early in the season; they should not be made thicker than eight or nine to the cwt. It is customary to set up a small portion of milk for butter, to be skimmed once and afterwards to be put into the cheese. The addition of this cold milk is an advantage to the curd, and it has been proved that when the milk requires to be warmed to make it of the proper heat (about eighty degrees) before adding the rennet, it is a much better plan to warm some of the milk when brought from the cow to a greater degree of heat, than to warm that which has been standing twelve hours and the cream taken from it; it has been observed that the cheese is much firmer by this plan, therefore it is well to adopt it. After the cheese has been in the press two hours, it should have the wet cloth removed, and replaced by a dry one, and if it be found that the curd is not properly closed, a second may be used before it is salted. The salt should be rubbed in at night to the cheese made

in the morning, and that made at night as soon as possibly convenient in the morning; three times is sufficient for thin cheese, and four times for thick, the cloth to be left off the last time of salting; afterwards a small quantity of salt may be used to prevent the cheese sticking to the vat during the time it is in the press, taking care that it is turned every day; and though it is not necessary for thin cheese to remain in the vat more than four days, it is thought an advantage, if there be press room, to leave it longer before turned out on the shelves; when there it must be turned every day. Avoid putting it in a draught of air when tender, as this will invariably cause it to crack.

This is the account given of the Gloucester cheesemaking. Let us now turn to the process as carried out in the Cheddar district, where the best cheese in the kingdom is made. This does not depend on the food or herbage of the district, but on the manipulation of the milk. Cheese is made in the *dairy*. Mr. Harding, of Compton Dando, Somersetshire, who has frequently visited Ayrshire for the introduction of the Cheddar system into that district, spoke thus at a meeting of the Ayrshire Agricultural Society:—"I am satisfied that whether we make cheese at Dalgig among the mountains, at Canning Park amongst forced grass, or among heather at Corwan, where Mr. Wason is making the desert to blossom as the rose, there is no difference whatever. My opinion is, that good cheese can, by good management, be made anywhere, whether at the Land's End or at Caithness, if it be in the hands of a person who has something in the upper story."

Cheddar cheesemaking, accordingly, may be described by reference to an instance in the county of Derby, as carried on upon the farm of H. Chandos Pole, Esq., of Barton Fields, near Derby.

Cheddar Cheese.—Mr. Pole is an enthusiastic dairyman, well acquainted with the dairy management of our principal dairy districts; and having been long convinced of the inferiority of that prevalent in Derbyshire, he commenced his endeavours to improve the manufacture of cheese soon after becoming the tenant of Barton Fields, and eventually decided on adopting the Cheddar system.

Cheese is the sole produce of the dairy, and from seven to nine tons are annually made, from a herd of about forty cows, and sold for from 75s. to 80s. a cwt., and the annual produce per cow thus varies from 14*l.* to 18*l.* in cheese alone. The whole annual produce was one year as high as 19*l.* 10s. per cow. The cows had been all at grass for a fortnight or longer before we saw them; up till then they had been receiving, as they severally calved and came to the pail, beans boiled to a soup and poured over their chop of mixed hay and straw. This, together with a few roots and 100 bushels of brewers' grains weekly among forty cows, was their feeding. They are brought in night and morning to the cow-house to be milked.

This is a long building, with double mangers, &c., across it at intervals, and doorways to each separate double row of about five cows, which thus occupy the breadth of the place.

The milk, as it is drawn each evening, is poured through a sieve into a cheese tub of about 160 gallons; or, if it be hot weather, it stands over night in large tin vessels, placed in a tank of water. These tins are, in that case, emptied into the tub in the morning, along with the morning's milk. In order to the saving of labour in the dairy, the boiler of a two-horse engine is fitted up in an adjoining room, and steam is thus driven off under pressure either through the pipes which warm the cheese room, or into the dairy itself, through the end of a pipe furnished with a universal joint, by which it may be delivered anywhere within reach. The evening's milk stands in the tub over night. The milking commences at five a.m. next morning. The milk is brought in pails, and poured through the sieve in among the evening's store, which has now become covered with cream. From two to four gallons of the sour yesterday's whey is added to every 100 gallons of the milk, either along with the morning's milk, if the night has been cold, or after it if it has been mild, or not at all if it has been hot, no whey being added if the temperature of the night's milk is over 64 degrees; and the whole is then heated up to 80 degrees by the introduction of the steam pipe, and the sending a lot of steam into the midst of it. The violence of the ebullition ensures the thorough mixture of the whole, and the steam is stopped on the indication of the thermometer. Rennet, a pint of water in which two or three square inches of a "vell"* have been steeping for twenty-four hours, is then poured through a sieve at the rate of a pint and a half to 120 gallons of milk, and mixed well by stirring; half an ounce of Nicholl's liquid annatto to every 100 gallons is at the same time added, and well mixed, and the whole is covered over with a woollen cloth. The curd should have fully come in fifty minutes.

The process of cutting—by thrusting up and down a framework of tin cutters, acting as a sieve with about a five-eighths inch mesh—is done with extreme slowness. Nearly a minute is taken in pushing this sieve-cutter from the top to the bottom, through, perhaps, two feet of curd. The whole surface is thus covered with the cutter, and the whole substance accordingly cut through. A few gallons of the whey baled out of a floating sieve are then heated in a vessel by the steam nozzle up to 120 degrees or thereabouts, and added to the mass, so as to raise the whole to the old temperature of 80 degrees, the whole being stirred and broken with rather more rapidity with the so-called shovel breaker, which is, in fact, a shovel-like tool, the "blade" being an open-work harp, or screen of

* A vell is the prepared stomach of a calf.

wires. The whole then stands covered up again for three-quarters of an hour. Twenty or thirty gallons of the whey are then drawn off, placed in a cistern above the tub, heated there by the addition of the hot steam to 150 degrees or thereabouts, and then set running into the tub again, the whole being rapidly stirred and broken by the shovel breaker, so that no part of it shall be unduly scalded, the whole being raised to the heat of 100 degrees of Fahrenheit. The curd thus acquires a certain firmness and consistency; it is left to settle in the middle of the tub, and covered up for half an hour, that the hot whey may exert whatever influence it possesses. The whey is then gradually drawn off and runs to the pig tank, a few gallons only being retained for use next morning. The curd is heaped up in the middle of the tub, and left half an hour to drain; it is then cut once and again, and turned and left again for half an hour to drain, after which it is taken to a tin curd cooler, broken into flakes by hand, and left for twenty minutes, being once turned over during that time. It is then put into the vat and under pressure for a quarter of an hour, taken out, weighed, and passed through the curd mill, and thoroughly mixed with two lbs. of dry salt to every cwt. of the curd. The whole lies in a heap on the cooler till of the temperature of 60 degrees, and it is then vatted and put under a lever pressure of 15 cwt. At night a dry cloth is put on, and it is turned. This is repeated at intervals of twelve hours until the evening of the second day, when it receives a calico cap, and is again placed in the press. On the morning of the third day it is swathed in a linen binder, and carried to the shelves of the cheese room, where it stands thoroughly protected for two or three months, being turned at first daily, and afterwards at longer intervals, until ready for sale. The cheeses weigh from eighty lbs. to one cwt., and are ready for sale in three months or thereabouts after making, wasting during that time about eight lbs. in every cwt. of the curd when weighed for salting.

Mr. Chandos Pole keeps an exact record of each day's process in a ruled book, in which are recorded the number of each day's cheese, the number of gallons of milk yielding it, the temperature of the evening's milk when the morning's is added to it, the temperature at which the whole is set to form curd, the time in forming, the state of the curd on breaking, its weight on salting, its temperature and condition when vatted, together with general remarks on the character of the curd. We gather from this record that in April 1996 gallons of milk yielded 1792 lbs. of curd when vatted, which would yield 130 lbs. less of ripe cheese; and that from the 1st to the 17th of May, 1660 gallons of milk had yielded 1553 lbs. of curd. The milk becomes richer in curd as the year advances, and more than one lb. of cheese is made per gallon towards the end of the year. Thus in October of last year we read on three successive days

that sixty-one, sixty, and fifty-eight gallons of milk made seventy, sixty-seven, and sixty-nine lbs. of the vatted curd.

It is plain that details of this kind will ultimately be exceedingly instructive, and we cannot doubt that Mr. Pole's experience thus carefully recorded will be a most useful contribution to any future investigation by which it may be attempted to extract the lessons of our English dairies.

Weaning calves.—The dairy should now be getting most of the new milk. The milk given to such calves as are being weaned mixed with oatmeal or linseed, as before recommended, may be taken from the quantity set up for butter, and once skimmed after standing twelve hours. Calves at five or six weeks old will grow fast and be in sufficiently good healthy condition, with half a pint of linseed or oatmeal prepared in the manner described at p. 176, and one quart or three pints of skimmed milk in addition at every meal. The milk should be placed in a tin vessel in boiling water to render it of sufficient warmth, and the quantity reduced according to the age of the calves, and regulated somewhat by the number kept, as their growth may be forced, to some extent, by higher feeding. Some good hay should be put to them twice a day, and some Swedes cut very thin, which they will soon take to eat readily if a bit is put into their mouths as soon as they have taken their milk, when they are disposed to suck anything that comes in their way. The food as above described has proved by long experience to be quite sufficient for the rearing of good useful dairy stock: calves so treated becoming fine heifers from this commencement at the end of three years, and in many cases even at two years old. A sufficient number of these young cows to supply the place of old cows turned from the dairy stock last autumn should now calve, and their young should run with them for as much as a fortnight, and then be sold, except in cases of particular favourites which may be desired for weaning on the farm. The heifers require some little time to become quiet and accustomed to be milked, which they will more readily allow with their calves by their sides; and the frequent sucking of the calves during the whole twenty-four hours makes the milking an easier operation afterwards. A run for a few hours in the day in a sunny field or orchard, with access to shelter, will do the weaning calves much good. The cows should now have the best food provided, the dairy cows on every farm being the stock at this time paying most for good feeding; and on ordinary farms by the end of the month some early rye-grass should be provided and be given to them in the yards in addition to their winter food, as a good preparation to their being turned in the grass fields next month, which often proves too great a change if suddenly done, producing too great looseness in the bowels, with falling away of flesh, and consequent loss of milk in the individuals so affected.

Fatting cattle continue to receive the liberal treatment proper to the last stage of the process of feeding. They are sold as they become ripe for the butcher. Mangold wurzel, oilcake, and chaff of hay are probably the principal foods employed.

The flock receives the same treatment as was fully described last month. The lambing season is not yet over, except in early districts. The feeding of fat lamb proceeds: the sheep and lambs being now folded on trefoil and rye, and receiving cut mangolds and peas or oilcake, or anything else they will eat, *ad libitum*.

In later districts, the experience of the sheep farmer is very different, as may be seen from the following report from a Lammermoor farm:—

Cheviot and black-faced ewes, having been fed on turnips, either at home or elsewhere, have probably returned to their pastures towards the middle of this month. Though there is little spring on the moors, yet having been very lightly stocked for some time, they are clean, so that the ewes do not fall off in condition. Those which are kept on turnips at home, being netted on for seven or eight hours during the day, and allowed to return to the pastures at night, do generally better than those which are in the low country, and constantly confined on the turnips. The first lambs now make their appearance, the black-faced leading the way; indeed, this breed generally come two or three days sooner than either the Cheviots or the Leicesters. The shepherds are now very busy. It is very useful, at this season, to have a few well-sheltered spots, conveniently situated, fenced off some time previous to the lambs making their appearance, into which ewes that are shy to their lambs, or have twins, may be put for a few days. This prevents much confusion and disturbance, as the shepherd knows at once where to find these special objects of his care; and, having been saved for a short time previous, there is generally grass sufficient for them; though when such is not the case, a few turnips, when to be had, will make up the deficiency. The jackets are removed from the hogs about the beginning of April, and the opportunity is taken of branding an initial letter on their horns. Experience of the jackets confirms the opinion of their utility. Out of 600 ewe hogs (only about seventy of which received ten weeks' turnips), the loss during six months has scarcely been one and a half per cent.; while, in respect of condition, they will stand comparison with many in the district which have had four months' turnips. When the jacket is removed, the wool underneath is found to have retained all the yoke it possessed in the end of November, when they were put on, affording a curious contrast to the bleached appearance of those parts which are uncovered. On a hill farm, if the twins are sufficient to fill up the blanks caused by death, it is all that is required. Those ewes having twins, together with some of the worst milkers, are put into enclosed fields,

where the grass is rather better, and where hungry lambs can be more easily assisted with cow's milk.

Swine.—On the general management of this stock, I shall this month give the substance of a paper lately (1861) read by Mr. Stearn, of Suffolk, a well-known breeder and feeder. He says:—

I have had experience in management of pigs a good many years. I raise them to the weight of between fourteen and fifteen stone, fourteen lbs. to the stone, at the age of between five and six months, dead weight; and between eight and nine stone, fourteen lbs. to the stone, live weight, at between twelve and thirteen weeks old. I find that the profit or loss of the pig rests on the quality of the stock, and it must be kept in mind for what purpose the animal is intended, whether for bacon or pork,—if for bacon flitches, you must choose a large kind, such as Berkshire, but if for pork, the small kind is most desirable, such as the Suffolk or Leicester, which are very similar animals, and every judicious breeder will have to take into consideration many circumstances in choosing a breed of pigs.

There is a pig called the improved black Suffolk, which many persons prefer to white, thinking they are more hardy, but I have fairly tested the thing of late and proved that the white will exceed the black as far as early maturity is concerned, and of course early maturity is where the profit is gained; and I find the better the quality of breed the more lucrative it becomes, much less food being required. Now for our white Suffolk breed. In choosing the sow and boar, the chief points are a smallish head, with short snout, wide chaps, the ears rather small and thin, ends sharp, pendulous, and pointing a little forward, broad and deep chest, round ribs, long in the body and short in the leg, the haunch or thigh dropped almost to the hock, back broad, straight or slightly curved, shoulders and hams thick, and the neck to rise well behind the ears, small bones in proportion to the flesh, the hair to be long, thin, and silky, tail small and curled. Strict attention to these points in selection cannot fail in perpetuating a good stock. Here I must add my surprise how careless breeders are in selecting the boar for their sows; if there happens to be a good animal within a short distance for the going to which half-a-crown is charged, they will often send double the distance to a thoroughly bad bred ugly brute for the sake of the gain of a shilling. Whilst this apparently paltry gain is so much looked after improvement is out of the question. As to the time for breeding, the sow should be from ten to twelve months old, and the boar from eight to twelve months. I, however, find that very few people will keep them so long, but breed them much earlier, which very often prevents their growing to the proper size, or acquiring sufficient strength for breeding. I think good sized sows are best for breeding, and more likely to have a number

of pigs. Great care should be taken not to save one with less than twelve paps, for it is observed each pig selects a teat for itself. I consider twelve good even pigs to be sufficient for any sow to bring up. The sow I exhibited at Framlingham and Canterbury last summer has brought up fifty-one pigs in four litters, without losing one. As far as my experience goes, the time of gestation averages about 113 days, or sixteen weeks and one day. Two good litters in a year are all we ought to expect. When a sow is in pig she ought to have liberty and plenty of exercise. The boars kept for stock should be confined in a shed with a roomy yard; if allowed to roam about, you are likely to get wrong in your breed. In managing the sow at the time of farrowing my practice is as follows: To have a man with her to attend to her; for it is absurd to have all the trouble and expense of keeping a sow, then, at the most particular time, to leave her alone to take her chance. In my idea there is not sufficient attention paid to the construction of piggeries; I have seldom seen one which I did not consider too small, except perhaps just for fat pigs, when, of course it does not so much signify, for the less a pig put up for fattening moves the better. But the farrowing pen ought to be large, to allow the sow plenty of room, and likewise to admit of rails being placed round the sides, so fixed as to prevent the sow lying on the young ones. These rails should be made to shift, in height from eight to twelve inches, according to the size of the sow, and they should extend out from the wall, about nine inches, having the supports carried up sloping from the side, instead of straight up from the floor; then when the sow lies down there will be no likelihood of her squeezing the pigs, as there is plenty of space left for them to pass between her and the wall, for nine times out of ten that is where the mischief is done, as sows invariably like to lean against something when they lie down. I have recently had a hundred pigs, without losing one from being crushed. Each place ought to be at least from eight to ten feet square, and the best floor, I consider, is asphalt. No damp or scent can rise from that; I tried boards, bricks, and almost everything in the way of floors; most persons would say boards are best, but I think I can convince you to the contrary. If you will consider for only one minute, they cannot be healthy; for if the boards are placed close, of course the moisture will stand, and the boards become saturated; and if a space is left the refuse litter will go between, so it will become one mass of putrid matter underneath, quite level with the floor whatever the depth may be; for what passes through will absorb the urine, and is likely to bring on many diseases. But I think it is well in the cold weather to lay down a false lattice floor on the asphalt, so it can be taken up once a week, and everything swept from under, for two or three weeks when the pigs are very young. I have the beds attended to and

fresh littered every morning, for I find the cleaner the place is kept, the better the pigs thrive. The floor being washed once or twice a week, everything runs off and the asphalt dries in a very short time. A tank should be made just outside to receive the drainage from the pounds, the building to be troughed to take off the rain-water, to prevent the manure being washed. The pens ought to be so constructed as to be closed up in cold weather, and well ventilated in warm. At the time of farrowing I allow a very small quantity of litter cut short, and have a hamper placed in the pen, with a little straw at the bottom and also an old blanket. I put a slip or partition about two and a half feet high across the pen to prevent the sow getting to the hamper; as the pigs come forth put them into it and cover them up, until the sow has done farrowing, after which put them to her and let them suck. When done, put them back in the hamper, give the sow a little warm milk and bran, and whilst she is eating this, have the bed attended to, by removing all the wet straw, &c. Add a little fresh litter cut short, then when the sow lies down let the pigs go to her again; by pursuing this plan there is very little danger of losing them, for I believe one-third are lost for the want of proper attention. I always give the man sixpence per head for all the pigs he can bring up to a fortnight old. I find this much the cheapest plan, for then there is no fear but he will see to them properly, and attend to them in the first instance, as well in the night as the day. How often do we hear people complain of the sow eating her own young? Therefore steps ought to be taken to prevent her doing so; for when once a sow does that she is of very little use for breeding purposes. If you will allow me, I will explain what I have found to be the cause. In some litters, the side teeth are much longer and sharper than in others; when this is the case, and the pigs begin to suck, they bite and scratch the paps, and punish and irritate the sow to such a degree, that it brings on inflammation, and the sow becomes mad with rage, she throws some one way and some another. At last she bites them, and if she once draws blood she will begin to eat them. Now the way to prevent this: when the pigs are a few hours old, I have them taken away in the hamper, so the sow cannot hear them, and nip these teeth out with a pair of pincers. I think about eight weeks old is a good time for weaning the pigs, and I like to have them operated upon a short time previous.

Now I will try and explain how I feed. I begin to feed the young pigs at five or six days old, with warm milk mixed with a little very fine sharps, and a small quantity of whole maize, out of troughs like some I will show you presently. For the first few weeks after being weaned, I have the boy feed them very often, but give them a very little food at a time, so they will clear the troughs out. In the winter I feed all with warm food, but not in the sum-

mer. I give them a great variety of meal, such as wheat, maize, barley, oats, and whatever is most convenient to mix together. I just wet it with cold water, and then scald it with boiling water, and sprinkle it with salt; between meals, I give them whole maize and mangold wurzel or Swedes cut small; and once or twice a day a little coal, but not too much, as it will be likely to do them harm. I allow them plenty of clean water; and there is one thing I am very particular about, not to give them any more food than they will clear up at a time. When pigs are put up fattening, it will be found very beneficial to wash them, at least once a week: this is quickly done by experienced hands, and will amply repay any one for the trouble. I also like to have them very often brushed. If you will only try the experiment between this and the common mode of treatment, you will be surprised at the difference. Store pigs ought to have their liberty as far as convenient, such as to range in large yards in winter, and the run of a piece of pasture in the summer. They should also be fed two or three times a day. Good bred and well fed store pigs will always consume the refuse from the farm and dairy, when a bad bred one will refuse. I have never known mine refuse anything in the way of pig food yet that was offered them, not even the prize animals. In my opinion the generality of pig-troughs are very badly constructed. They cannot be too shallow, according to the size of the pigs, to prevent their getting deformed. Their shape is very often injured through not using a suitable trough. I have a great many different sizes, and use them to suit the animal.

Mr. Stearn uses coal as an astringent, and it acts almost immediately; but in two or three cases he has given too much, and has been near losing the pigs. To a pig from seven to nine months old he gives, if the animal requires anything of the sort, about as much coal as will lie in the palm of his hand twice a day.

In the discussion which followed Mr. Stearn's paper read before the Framlingham Farmers' Club, Mr. Sexton, another distinguished pig-breeder, who chooses the black sort, described his experience. He thinks the black are hardier, quite as good breeders, and will eat quite as quick. As to feeding, as soon as the pigs will eat he gives them a little meal or oats; the oats whole. He never gives them any peas till they get twelve or fourteen weeks old, finding it cramps them. Lentils and oats are the principal food; he grinds the lentils, and after a time he grinds the oats and gives them wet with a few sharps and middlings. When the pigs are over three months old, he gives them barley, and a little before that time he also gives a small proportion of maize. He gives everything cold, in winter and summer. He finds if he gives warm victuals, when the pigs get eight or ten weeks old their lungs are gone. He sells his pigs for London, at between four and five months old,

at about five stone. He generally kills them at from 40 lbs. to 70 lbs. weight. He gets the young pigs to eat as soon as they will. He can get them to eat a little at six or seven days old. He does not agree with keeping the sows over well.

MAY.

The ordinary weather of this month will be gathered from the meteorological table on next page, compiled by Mr. Lowe, of Nottinghamshire, in which the temperature and rainfall for a number of years at different stations in England are specified.

The ordinary farm operations of the month of May direct our attention to such subjects as (1) *Breaking up Grass Lands*; (2) *Payment of Labour by the Piece*; (3) *Turnip Culture*, and the cultivation of other drilled green crops; (4) the cultivation of various crops not commonly grown, whose seed-time is in May, as *Buckwheat*, *Lupine*, &c.; (5) *the Grain Crops of the Farm*; (6) *Live Stock management*.

I.—BREAKING UP OLD GRASS.

The method of accomplishing this by paring and burning was referred to in page 164. Early spring and on till the present month is the best period of the year for the process.

The policy of breaking up any particular grass field has of course already been considered and decided on, as the operation ought to be completed in the month of May, in order to the obtaining of a good crop of Swedes or turnips the same year. Nevertheless, it may be well to discuss here in greater detail the general question of the extension or diminution of grass land cultivation in this country.

The question—"Shall I break up my grass lands?" is but a particular case of the more general inquiry—"What crops, under given conditions, is it most for my interest to cultivate?" Under some circumstances, no doubt, and especially when that crop has already obtained an establishment, an intelligent review of the case will indicate grass as the most profitable plant to grow; and then it will of course be unprofitable to adopt arable culture. In other cases (and in these it is necessary to adopt a *rotation* of crops) wheat, barley, oats, Swedish turnips, mangold wurzel, clover, &c., will appear to

THE WEATHER OF MAY.

LOCALITY.	AUTHORITY.	Mean temperature.	Lowest temperature.	Highest mean temperature.	Greatest heat.	Lowest maximum heat.	Highest minimum cold.	Greatest cold.	Average amount of rain.	Smallest amount of rain.	Greatest amount of rain.	Average number of rainy days.	Smallest number of rainy days.	Greatest number of rainy days.	No. of years observations.
Guernsey.....	Dr. Hoskins, F.R.S.	51.2	48.8	54.4	70.0	62.0	45.0	39.0	inches. 2.5	inches. 1.1	inches. 4.1	12	6	18	12
Helston	Mr. M. P. Moyle ..	55.6	51.8	60.6	78.0	68.0	42.0	32.0	2.3	0.5	4.0	10	4	17	16
Exeter.....	Mr. W. H. Ellis.....	53.1	49.6	60.2	83.0	72.2	40.2	31.6	2.3	1.3	3.5	15	6	21	13
Ventnor, I. of Wight	Dr. Martin	54.0	49.7	60.0	77.0	63.0	46.0	34.0	2.1	0.3	7.9	12	4	21	22
Worthing, Sussex	Dr. Barker	50.8	47.9	52.5	73.4	62.6	38.8	32.0	2.4	0.9	3.5	11	5	19	8
Clifton, near Bristol	Mr. W. Burder, F.R.A.S.	50.9	48.2	53.4	82.3	68.8	37.3	28.8	2.7	2.1	3.5	16	11	22	8
London Royal Observatory	{ The Astronomer } Royal, F.R.S. }	52.6	47.5	59.7	86.2	65.0	45.3	28.3	2.2	0.4	3.9	13	3	20	90
Bedford	Dr. Barker, F.R.A.S.	51.9	48.8	54.9	85.7	73.5	34.5	28.5	2.1	1.1	3.2	14	10	23	10
Lampeter, near Cardigan	Rev. Prof. Matthews, M.A. ... }	51.0	47.3	55.4	81.2	70.0	31.0	21.4	2.3	1.0	3.2	15	8	18	6
Norwich	Mr. W. Brooke, F.R.A.S.	50.8	43.1	57.9	87.0	65.0	40.0	28.0	2.1	0.5	4.8	13	4	24	21
Highfield-House Observatory .. }	Mr. E. J. Lowe, F.R.A.S. ... }	53.1	48.5	60.0	84.5	70.8	40.0	26.8	1.9	0.5	5.0	13	7	21	51*
Oxford Observatory	Rev. R. Main, F.R.S.	52.4	48.4	57.9	81.1	68.5	37.0	27.7	1.9	1.0	4.3	13	7	20	33
Grantham	Mr. J. Jeans, F.R.A.S.	50.4	46.8	52.8	81.1	69.3	34.9	27.3	1.5	0.5	2.9	14	8	20	10
Hawarden, Chester	Dr. Moffat, F.R.A.S.	49.0	47.3	51.6	78.0	67.8	37.0	28.0	2.0	1.4	2.9	11	6	17	10
Manchester.....	Mr. G. Vernon F.R.A.S.	51.8	48.5	54.5	84.0	67.0	36.0	24.0	1.8	0.4	2.9	14	3	21	12
Leeds	Mr. H. Denny	51.4	46.0	54.0	86.0	71.0	34.0	24.0	1.6	0.7	3.6	13	6	20	10
York	Mr. Ford	51.5	45.8	58.8	80.0	64.0	41.0	25.0	1.8	0.4	4.0	13	3	20	20
Scarborough	Mr. B. Cooke	47.2	44.0	51.1	67.9	60.0	38.0	29.5	1.7	0.7	3.1	7	2	14	6
Isle of Man.....	Mr. J. Burman, F.R.A.S.	47.7	46.4	53.0	78.0	64.1	36.1	29.4	1.9	0.2	2.2	11	3	17	7
Durham Observatory	Mr. A. Marth, F.R.A.S.	48.8	43.6	55.9	76.4	59.9	37.5	27.1	1.9	0.3	4.4	12	3	21	12
North Shields	Mr. R. Spencer	48.8	45.0	51.5	75.8	57.5	37.8	27.5	2.3	0.2	6.8	18	4	27	16
Silloth	Rv. F. Redford, F.R.A.S.	50.3	48.4	52.0	79.2	63.3	35.0	28.7	1.8	0.1	2.9	12	3	19	7

* Observations at Highfield House on temperature extend over fifty years, and at the Royal Observatory over ninety years.

promise the greater profit; and then the fact of the land being at present in grass does but afford the stronger inducement to convert it, for the "rest," &c., which it has enjoyed for so long are circumstances greatly conducive to fertility. The substitution of wheat, potatoes, &c., accompanied by the mode of cultivation which suits *them*, for natural grass and the simpler treatment found to favour *its* production, is of course a greater change than that merely of wheat for flax, or of beans for potatoes, in any particular rotation already adopted; it is, however, a change of the same description, and it involves a question whose answer is to be determined by the same rules. And it is probable that when the greater intelligence which the better system doubtless requires shall become more general, the clauses in our leases which attach pains and penalties to the putting of plough into pasture, will be as commonly condemned as those already are which refuse a place in the rotation to certain crops now known as profitable for all parties to grow.

In the meantime the substitution of arable crops for pasture is one on which the widest difference of opinion exists. One will say:—What can be clearer than that it is the interest of the nation that its present grass lands should be made to yield the larger acreable produce of arable culture? Would not the change be productive of more food for the people? Would it not occasion more employment for the labourer? And would it not yield larger profits and higher rents for the tenant and the landowner? And, it might be further asked, are not the industry and foresight which the change would call into exercise preferable in every point of view to the sluggish indifference which the present system permits? For over large districts at present the farmer does but take what Nature, almost unassisted, puts into his hands, and the more artificial system which we recommend would require both energy and thoughtfulness for its successful development.

These questions, put generally, doubtless all rightly claim answers in the affirmative; and yet he who should hastily proceed to put the altered practice they imply into extensive or indiscriminate execution, might find at the close of his operations that he himself has derived no benefit from them, and that they have been productive of no permanent good to the neighbourhood. The peculiar results of his case have been the consequence of its peculiar circumstances; and these, it now appears, he had not duly considered. He had not sufficiently calculated on the large outlay for farm buildings which the improved cultivation has required; he had not thought of the larger capital involved in arable culture which tenants have not been able to provide, and he had not considered the greater energy and intelligence which are necessary in arable farming, and which they did not possess. It appears, too, that in his hurry he converted pastures which were more profitable in their original condition; and

that in his zeal he refused to leave the particular fields of meadow which arable farmers would afterwards have found so convenient; and lastly, it appears that the prospect of employment having induced the settlement of labourers from a distance, the parish poor-rates have not been lessened by his improvements. To be sure, the annual value of the estate was raised; but not permanently so, for the cultivators of the land took undue advantage of its fertility, and its value to farm was soon reduced by their mismanagement; the profits of its farmers at first were certainly great, but they fell off as the land deteriorated; the number of labourers employed was indeed large to begin with, but it diminished as profits fell, and those who in the prospect of employment had obtained a settlement in the parish are now simply an addition to the burden which oppresses it; and lastly, in consequence of all this mismanagement, the annual gross amount of human food produced on the estate, doubled or quadrupled as it was during the first two or three years of its arable culture, does not now exceed its original amount.

What has been the cause of this failure? For it was by no means a necessary consequence. It must be attributed to want of consideration in the landlord; and to want of intelligence in the tenant.

Permission to break up a pasture-field is always considered a favour done to the farmer, and it is generally accorded either as the only method of quieting complaints of an over highly pitched rent, or in consideration of an increased annual payment. Now, what the landlord desires, and what of course can alone render it his interest to grant this permission on any extensive scale, is that this increase of rent be permanent. This can be attained only by a similar permanence in those circumstances on which rent depends, viz., the fertility of the land, and the excellence of its cultivation; and to these points we must therefore first address ourselves:—"How can the fertility of what is called 'new land' be maintained?"

It must be acknowledged that this has been the great difficulty with most landlords. Pasture-lands are not so liable to maltreatment as those which are under the plough. They can but be robbed of their natural produce of grass; and that will dwindle away as the land deteriorates without the entire impoverishment which in arable culture is produced by cross-cropping. And the history of many a badly-managed grass-farm is but a record of this gradual deterioration, until, the rent being ultimately loudly complained of, the land has been broken up, only to undergo that more rapid impoverishment to which it is rendered liable by the more efficient means of exhaustion which arable culture supplies. I have known many pasture-fields maltreated thus: permission has been obtained for their conversion; they have been made to bear repeated crops of wheat;

and when they could yield no more, they have been laid down for "rest," as it is called, and, after the lapse of years, broken up again, simply to undergo a repetition of this mismanagement. The first essential, then, to be obtained before such permission be granted is *sufficient intelligence in the tenant*: such intelligence as will enable him to see his own interest in the adoption of an alternate system of husbandry. And with such intelligence, provided the other necessary conditions be fulfilled, I believe there is no risk whatever of endangering the annual value of an estate by leaving its cultivation entirely to the will of its cultivators; binding them, however, it may be, by such few and simple regulations as they will themselves heartily admit. Let one of these stipulations be, that each year half of the land, whether it be "new" or "old," shall be made to produce crops of food to be consumed on the farm; and another, that no straw be sold off the land. And if a hearty and intelligent acquiescence in these be accorded by a practical man, of ordinary energy and sufficient capital, and acquainted with approved methods of husbandry, we would not fear to let him the land to cultivate it as he pleased. Under *these* circumstances, no landlord need fear injuring his estate by converting its pastures.

And it is satisfactory to find that the researches of scientific men corroborate the experience of the agriculturist on this point. Every soil contains enormous supplies of those substances on which fertility depends; supplies existing, to be sure, for the most part in a sort of dormant condition—for but a small portion is at any one time available as the food of plants; and that small portion may be removed by cross-cropping, and sterility may thus be produced; but this is only temporary, for rest and exposure during rest to the influence of atmospheric solvents, will prepare from the almost unlimited storehouse at command, a fresh stock of food for ensuing crops. All this is borne out by experience, and the truth of a theory is thus established on which we might raise a conclusive argument for the permanence (under conditions of proper cultivation) of that fertility which a newly broken-up pasture-field always possesses, and on which, of course, its value to rent depends.

General truths of this kind, however, require to be fitted to the circumstances in which their truth is profitable as well as unquestionable. There can be little doubt that the poorest of thin, dry pastures—the majority of our down lands, for instance, are better retained in their present condition than exposed to the risk of that rapid deterioration to which arable culture would expose them. And as little doubt can there be that our richest grass lands afford a much larger margin of profit to the occupier, and of rent to the owner, than under any other mode of management could be obtained. The richest grazing grounds of this country are by much the most valuable land for agricultural purposes that we have; and no single

plant could yield by its cultivation so steady and constant, and so high an annual return, as is afforded by that mixture of grass-land plants which good pastures contain.

There is, however, an immense extent of inferior grass lands in this country, which might profitably be broken up. These are for the most part our low-lying undrained pastures, either clayey, or, because wet, of an adhesive texture; they produce large quantities of the Sedge (*Carex*), intermingled with the other grasses; they are to be found in large tracts on our blue lias, coal, and old red sandstone geological formations; and large portions (provided only we could get capital for tenants and capital for landowners—the one to enable their due cultivation *afterwards*, and the other to lay out in drainage and buildings *now*) might be broken up with profit immediately; and, doubtless, all of them will be broken up with profit to all parties concerned ultimately.

A farm in my own occupation afforded a good illustration. A few years ago, it for the most part consisted of cold, undrained meadows. The difference between its former and ultimate value was doubtless owing, in great measure, to a large outlay on buildings, roads, and drainage; but what gave these their influence was the permission of the landlord to break up these pastures. In the following table I have selected some of its fields, and stated their original valuation, and their value ten years afterwards:—

1.	2.	3.	4.	5.	6.	7.
No. of field on old plan.	Nature, 1836.	Original acreable value.	No. on new plan.	Nature, 1846.	Ultimate valuation.	Difference in value at an interval of ten years.
		<i>s. d.</i>			<i>s. d.</i>	<i>s. d.</i>
The whole farm.		22 9	...	...	47 0	24 3
92	Pasture	13 0	} 8	Arable	50 0	35 0
84	Do.	17 0			50 0	23 0
59	Do.	27 0	2	Do.	34 0	21 6
89	Do.	11 0	} 16	Do.	52 0	35 0
91	Do.	12 0		Do.	50 0	30 0
67, 71, 72	Do.	17 0	1	Do.	32 0	21 0
75	Do.	20 0	6	Do.	47 0	34 0
105, 106	Do.	11 0	24	Do.	44 0	8 0
85, 86	Do.	13 0	7	Do.	44 0	10 0
*143, 144, 152	Arable	36 0	12	Do.		
*153	Do.	34 0	13	Do.		

This is undoubtedly an extraordinary and an instructive table; but let me first justify the items in the sixth column by a history of some of these fields.

* These were dry grounds—"the best potato grounds in the parish."

No. 8 (see col. 4) was one of the poorest fields on the farm; it was drained some years ago, and pared and burned in the autumn of that year. It was ploughed into perch-wide ridges, without reference to the position of the drains, and it lay so till the following spring, when it was sown with oats, and yielded a large crop—upwards of eight quarters per acre. The stubble was ploughed, and next spring it was manured and grubbed or “cultivated,” and sown with mangold wurzel, and it yielded an enormous produce of that root—forty tons per acre; in the following year, it was sown with wheat, and yielded upwards of forty-six bushels per acre; after that it was planted with potatoes, but these partly failed; the year after that it bore wheat again, and never was a finer looking plant than that which covered it in the month of June; but the weather of July laid it, and its produce was greatly injured both in quantity and quality. Clover seed and Italian rye-grass sown among the wheat yielded a very luxuriant crop of grass. The rental of this field is not put too highly at 50s.

Now take No. 2, a field of much better quality in its original condition; its rent was, in fact, double that of No. 8.

It was pared and burned, and sown with common turnips, of which it yielded upwards of twenty-five tons of bulbs per acre; oats, a crop of ten quarters per acre; white Belgian carrots, twenty-two tons per acre; wheat, forty-two bushels per acre; swedes, not a very good crop. Wheat and rye-grass have since been successive crops. Its gross annual value is properly put at 50s.

The farm is, in fact, on the whole, more than double its former value; and some of its parts are worth four times their former rent. This is to be attributed partly to the advantage of good farm buildings and roads—in great degree to the influence of a perfect drainage; and, for the rest, to the conversion of its pastures—to the *conversion of its pastures* not simply considered in itself, but as affording opportunities for the application of capital and skill. It is difficult to divide this whole result amongst its several causes; but here is a fact which will assist us. Nos. 12 and 13 (see col. 4) were dry, arable, and well farmed in their original condition; they have increased in value about 9s. per acre since 1836. We will suppose this to be attributable to their share of the advantages arising from good farm buildings and roads. Let us, then, consider that these advantages are worth 9s. per acre on the other fields, and subtracting this sum from other fields, we have a rise in annual value of 14s., 26s., and 26s., and so on, as the effect of drainage and conversion under the plough. And putting 10s. and 15s. per acre as due to the operation of drainage, we have 4s., 11s., and 11s. as the acreable consequence of arable culture in these instances; and the greater advantage in the two latter cases teaches the policy of breaking up the poorer lands first, especially if they are wet, and if their soil and

subsoil together constitute a sufficient depth of improvable material.

In reference to the landlord's interest in the conversion of his pasture land, we may safely arrive at the conclusion, that, after deducting all those portions of his estate whose conversion to arable land would injure to any great extent its landscape beauty, as well as those portions which it is advisable should remain on each farm, as a convenience for the tenant; having deducted, moreover, all those portions already yielding an abundant rent, and those which he is perfectly convinced would not yield him so much more rent as would pay a sufficient interest on his necessary outlay for buildings, drainage, &c.—then, with the rest, it is the interest of the proprietor to proceed, beginning with fields of poorest soil, and building, and draining, and breaking up as fast as his means will enable him; and, as fast as he can obtain tenants of the requisite trustworthiness, intelligence, and capital.

Mode of breaking up grass lands.—This has been already named at p. 164. I add some further remarks.

In giving permission, the landowner will, doubtless, specify the mode in which he requires it to be done. All clay pasture lands should be pared and burnt; there are many advantages attending this operation in all cases, but there are some peculiar to claylands—such as the improvement it effects in the texture of such soils. At the same time it should be remembered, that land when wet will appear to have an adhesive texture, which when drained will prove a friable open soil; and therefore no decision on this subject is advisable until after drainage. The object of the landowner in naming the terms on which he will permit the farmer to break up grass land, should be to arrange so that he may have half of his land in green crop and half in grain during the first and all succeeding years; and in the case of clay land it is necessary to burn all, because while there is no immediate necessity for it in the case of that half of it which is to be sown to oats, beans, or wheat, as the case may be, yet on such soils the sward will not have been sufficiently reduced by the ploughing and rest for a year, which that half of it will thus receive, to answer for the green crop, which in the succeeding year follows those crops. In the case of light land, however, there is no such difficulty; and, therefore, on such soils it will be advisable to *plough* the half intended for grain crops (it will thus be sufficiently rotten and reduced by next spring for green crop culture), and to pare and burn the half intended for turnips, swedes, &c.

The farmer has to superintend and bear the expense of all these operations. The amount of expense he will incur beyond the ordinary cultivation of the land will probably be 30s. to 40s. per acre on half of the pastures converted. If he enters on the land at Michaelmas, which will be the most convenient term for him, he will be able to

plough those grass lands, *which are to be ploughed*, in the autumn. The grass should be cut close, and the land ploughed about five inches deep; and it will be the better of being rolled before winter, so as to press the furrow-slices home, in order that no grass may grow between them. In March, four bushels of oats per acre may be sown broadcast—they will fall into the furrows, and spring up as if they had been drilled; they should then be harrowed up and down, and across the former ploughing, rolled, and left till harvest. The farmer will also, during winter, be able to get all the hedge-rows that are to be removed grubbed up.

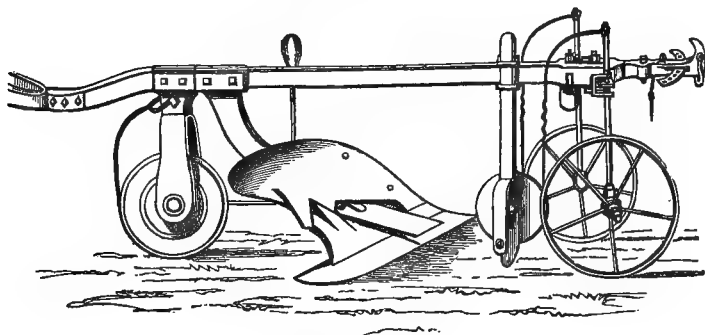
With regard to those fields which are to be pared and burnt, they must lie till the spring; but in ordinary seasons there will be no difficulty in getting them ready, part for Swedes and part for common turnips. They may be pared either by hand or by plough: in the latter case, it is right to cut the land by circular shares drawn over it, arranged on an axle and weighted, so that they shall pierce the sward in lines about a foot apart. The paring-plough (Snowden's Paring-Plough, Fig. 33, is the best tool for the purpose) in crossing these lines, and turning over a furrow-slice about ten inches wide, will turn over, not a continuous riband of turf, but a series of patches about a foot long, ten inches wide, and one inch deep. These are more manageable in the burning. This ploughing, I imagine, will cost about 9s. or 10s. per acre. The burning should be done in as large heaps as possible, and as slowly as possible—the one to ensure against the fires being put out by every passing shower, and the other to ensure black ashes.

The next operation is to plough this land shallow (say three inches deep), in narrow furrow-slices, and thus bury the ashes. The ploughed land should then be rolled hard, and harrowed twice or thrice lengthways; and, lastly, twice or thrice across the ploughing—and the soil should by that time be pretty well torn to pieces. Let the land be then again rolled, and ploughed six inches deep across the former ploughing. This will bring up the three inches of fast land below the ashes, and bury those three which had been on the surface; the ashes, as before, being between them, or three inches deep in the ground. If the same succession of rollings and harrowings be again repeated, the land will be ready for that drilling up at intervals of about twenty-six inches, which prepares it for the seed. In ordinary seasons a large extent of grass land may thus be broken up in one season, half of it being got ready for a crop of Swedish turnips, to be sown towards the end of May, and the other half for a crop of common turnips, to be sown a few weeks later.

Snowden's Paring-Plough, referred to above, which, with the exception of the plough handles, is shown in the annexed figure, is a tool with a broad flat share and a short abrupt mould-board pierced at foot by a horizontal slit, through which a cleaning blade is thrust

to and fro by a crank movement from the hind wheel, on which the weight of the tool rests. The intermittent motion of this blade has the effect of cleaning the share, and so of keeping it in working order.

Fig. 33.



Snowden's Paring-Plough.

In addition to thus cutting the turf from its bed in as shallow a slice as may be desired, a circular coulter makes a longitudinal cut, and a blade upon the same axis with it (represented hanging downwards in the figure), revolving once with every revolution of this coulter, is in use for the purpose of cutting the longitudinal slice transversely in lengths of eighteen or twenty inches. It is less efficient, however, in this respect than as a paring tool, and for this purpose it is much the most efficient implement we have. It is generally exhibited at our agricultural shows by Messrs. Hancock, of Gloucester, and costs about 5*l*. For drawings of this and many other agricultural implements I am indebted to the courtesy of Mr. O'Doherty, the manager of the Agricultural Engineers' Company, Swan-lane, London Bridge, who has kindly given me free access for this purpose to the large stores of agricultural machines in their warehouse.

II.—PAYMENT OF LABOUR.

The merits of the two systems of paying labourers by the piece and by the day respectively were ably discussed the other day (1861) before the London Farmers' Club; and as at this season, in hoeing and mowing, and paring and burning, and other operations, the alternative is always presented to the employer of labour, I will transfer to these pages the arguments and reports brought to bear upon it by Mr. C. Howard, of Biddenham, near Bedford, on the occasion referred to. He said:—

“Labour has ever formed an important item in the cost of farm operations; but at the present day, when so much stock is reared,

such large crops are produced, and so much machinery is employed, the balance-sheet shows that labour, upon the well-cultivated farm, forms the largest item of expenditure; and the want of knowledge as to the best mode of directing labour, and as to the value of the various operations in husbandry that manual labour has to perform, have been the cause of many a good man's downfall.

"A farmer is far from being so advantageously placed as the manufacturer in letting his work by the piece, inasmuch as it is impossible for all the work of the farm to be performed on that system; a great deal, such as the feeding and tending of stock, carrying corn to market, and many of the field operations, cannot be done otherwise than by the day. Again, the farmer has to contend with the elements; and, if ever so disposed to keep his men at piece-work, the weather frequently prevents him. Again, some farmers, like myself, have a well-conducted set of men, whom he is disposed to keep all the year through; and at certain seasons, when work is not very plentiful, there is no inducement to the farmer to set his men to piece-work, which would have the effect of raising his weekly expenditure. Still I think the system might be advantageously extended, for I find upon farms where piece-work is generally adopted the work of the farm is always in a more forward state than where the day system prevails, the men are better off, they are more active and more skilful. It is a well-known fact in the commercial and manufacturing world that those trades have made the greatest progress, in which piece-work has been the rule; and I think this may be partly accounted for on the ground that the men feel an interest in facilitating the various operations upon which they are employed: the energies of their minds are also bent upon finding out easier and quicker methods of getting over their work. Put a set of men by the piece, at once a rivalry is felt as to who shall do the most work, or, to use their own words, be the "best man." If there is any rivalry amongst a company of day workmen, it is on the other hand too frequently as to who shall do the least, and, in many cases, who shall best deceive his master. Piece-work, too, is the readiest way of making a difference between the good and indifferent labourer; and the plan adopted by many who wish it to be the rule, is to pay a comparatively low price by the day, in order to induce their men the more readily to take piece-work.

"I find that most of my correspondents strongly recommend piece-work where practicable, and consider it would be beneficial both to the employer and employed if it were considerably extended. In the northern part of England and in Scotland, I learn that there is not much work done by the piece, in consequence of the practice of having yearly or half-yearly servants. In most of the counties of England it is carried out to a considerable extent; and the opera-

tions by the piece are hoeing of corn and root crops ; filling and spreading manure ; mowing grass and seeds ; washing and shearing sheep, cutting, carting, stacking, and thatching of corn ; laying and trimming hedges, ditching, draining ; mangold pulling ; turnip cleaning, heaping, and covering ; cutting haulm, and threshing Lent corn."

The reports of some of Mr. Howard's correspondents are exceedingly interesting. I quote two reports from England and two from Scotland. Mr. Battams, of Carlton (Bedfordshire), says :—

"Although I have thrown the plough in the ditch, I will refer to my labour-book, and give you the prices paid upon my farms for piece and day work. I will commence with my first operation, grubbing up about 60 acres of woodland. This cost 8*l.* per acre. It was then drained 4 feet deep, at 2*s.* 6*d.* per chain. I next dug with spade 90 acres of old grass covered with ant hills. This was done at 2*l.* to 2*l.* 2*s.* per acre. It was then drained 4 feet deep, at 2*s.* and 2*s.* 3*d.* per chain. The old ploughed land was drained the same depth, and at the same price, except where the pickaxe was used. This cost 3*s.* 6*d.* to 4*s.* per chain. The above was extraordinary farm work. I had more than 100 men employed at one time, my sons superintending the work ; it was done well, and the men earned 12*s.* to 15*s.* per week, and some even more, in the winter months. I now come to ordinary farm work, done by the piece : trimming hedges, 2*d.* per chain ; singling turnips, and hoeing the side of the ridge after the horse-hoe, 5*s.* to 6*s.* per acre ; topping and pitting turnips, 6*s.* ; mangold wurzel, singled by the day, and for pulling, topping, and placing in rows for carting, 3*s.* ; bean dibbling, 2 feet apart, when the rows are marked out, 3*s.* 6*d.* ; if unmarked, 4*s.* 6*d.* per acre ; hoeing ditto twice after the horse-hoe, 6*s.* ; mowing clover, 2*s.* ; mowing grass, 2*s.* 6*d.* to 3*s.* per acre, with 3 pints of beer per day ; mowing, sheafing, raking, and shocking wheat, barley, and oats, 7*s.* to 8*s.* ; pea hooking, 4*s.* 6*d.* to 5*s.* 6*d.* ; bean hooking, 7*s.* 6*d.* per acre, with 4 pints of beer per day ; thatching, 1*s.* per square of 100 feet, with beer ; harvest carting, 3*s.* 6*d.* per day ; ordinary day labour, 11*s.* per week ; men attending the steam engine, 15*s.* per week, with beer ; horsekeepers and shepherds, 12*s.* per week, with house and garden rent free. I think it desirable to have work done by the piece where practicable ; but I find three-fourths of the ordinary work of the farm is performed by the day, and I cannot well see how it is to be avoided, with so many men attending stock, and the threshing, chaff-cutting, grinding, and a great part of the cultivation of land done by the steam-engine ; but even this day labour may be done very satisfactorily, where a good feeling exists between the master and the men, the former devoting sufficient time to the superintendence of the workmen." Mr. Battams adds, "I have not noticed the cost of paring and

burning old grass land, as I think the necessity of doing it almost exceptional. I prefer double ploughing; what I have burnt cost 2*l.* an acre."

Mr. Hudson, of Castleacre (Norfolk), says:—

"There is not so much piece-work done on the farms in this district as in former times; but we prefer that system when the men will take the work. The drilling is done by the acre. The man who leads the horse, and the man who guides the drill, are paid each 3*d.* an acre, if the work is done well; they earn about 3*s.* a day each. Fencing is paid for by the rod of seven yards, at from 9*d.* to 1*s.* a rod. The manure is filled by the load, at 1½*d.* per load; manure heaps turned over at 1*d.* per load. Turnips are hoed out at 2*s.* per acre, and singled by hand at 1*s.* 6*d.*, and hoed round each plant at 3*s.* an acre, besides being horse-hoed three or four times between the ridges. Clover is mown at from 2*s.* to 3*s.* 6*d.* and 4*s.* an acre. The harvest work is taken by the men on the farm, who cut the barley and oats, and pitch, load, and stack the whole of the crop, including wheat, at from 6*l.* to 6*l.* 10*s.* per man, the wheat being cut by machines, and tied up by women, at from 2*s.* 6*d.* to 3*s.* an acre, according to crop. Rix's gathering rake is of great use in getting the wheat into sheaves, ready to tie up. Barley is gathered and heaped at 6*d.* an acre. In the autumn the swedes are placed in rows of from six to eight drills together, at 2*s.* 6*d.* an acre. If topped and tailed, and loaded on carts, or heaped ready to cover up, 4*s.* an acre. Stones are gathered from the clover layers, and put at once on carts, instead of being laid on the ground in heaps, at 1*s.* per load of 24 bushels. Hay stacks are thatched at 4*d.* a yard run at the eaves; corn stacks, at 5*d.* per yard run. Threshing is done by steam power; the dressing by hand; the men earn from 11*s.* to 15*s.* per week."

Mr. Wilson, of Edington Mains (Berwickshire), replies:—

"Our towns and villages are small and wide apart, so that there is a necessity for the labourers required for each farm to be resident upon it; and accordingly a row of cottages forms an invariable part of every homestead. The 'hinds,' as our farm labourers are called, are engaged by the year from Whitsunday to Whitsunday, the engagement taking place about the 1st of March. A hind's wages at present consists of 4*l.* in money, 54 bushels of oats, 21 bushels of barley, 9 bushels of peas, the keep of a cow (grass in summer, and 3 tons of turnips and straw in winter), food during harvest, say for a month, and a small money allowance when delivering grain. This will amount to about 10*s.* per week, taking one year with another. Being a yearly servant, his wages are not liable to deduction from bad weather or casual sickness; but with the terms already enumerated, there is associated a further arrangement, by which the hind engages to furnish throughout the year the services of a female or

stout lad, popularly called a 'bondager,' for whose work the hind receives at the rate of 1s. per day from Candlemas to Martinmas, and 10d. from the latter to the former term, with the current rates of harvest wages, say from 2s. 6d. to 3s., while reaping is in hand, and food all harvest. On consideration of keeping this field-worker or bondager, he further gets a cottage and small garden rent free, has what coal he requires carted by his employer, and gets one-third of an acre of land on which to plant potatoes, the farmer supplying manure and horse labour, the hind providing the sets and undertaking the hoeing and digging of the crop."

Mr. Peter MacLagan, of Pumpherstone (Mid-Lothian), states he prefers piece-work to day-labour, considering it more profitable to the employer, and an encouragement to skill and industry to the workman.

"In Mid-Lothian very little of the work is done by the piece, except hay-cutting, which costs 2s. 6d. to 3s. per acre, without beer. Potatoes are occasionally, after being dug or lifted, raised and sacked ready for market at 9d. per boll of 4 cwt. When harvest work is done by the day, the reaping is performed by a machine or by a band of reapers, overseen by a careful man, two reapers being put on a ridge of eighteen feet, and one man binding to four reapers. Formerly, when sickles were used, and the work was performed more slowly, one man bound to six reapers. At the present day there are certain men in every district who make a business of contracting for the cutting of the crop; they supply all the workers, and obtain lodging at the steading, with, perhaps, milk for their porridge. The price of cutting, gathering, binding, and shocking is from 8s. to 10s. per acre. Draining is always done by the piece, at a cost of 1s. 8d. to 2s. per chain of twenty-two yards, three feet deep, and from 2s. 6d. to 2s. 8d. for four feet drains. The practice in Mid-Lothian of hiring the hinds is the same as in Berwickshire; but the annual payment is as follows:—65 stones of oatmeal, 12 to 16 cwt. of potatoes, and 22*l.* in money; in East Lothian, 9 qrs. of oats, 18 bush. of barley, 24 to 32 cwt. of potatoes, 2 qrs. of beans, keep of a cow for one year or 6*l.*, list money 1*l.*"

Mr. Howard reports his own management and prices as follows:—

"My practice is to let as much work as I possibly can, particularly to the best conducted of my men, and those who have large families. The work done in this manner, commencing after harvest, is the filling of manure, for which I pay for the heap or for emptying the yard; I consider this plan preferable to paying by the load; there is no dispute then about the size of the load. The trimming of hedges, with the bushes raked, at 2½*d.* per chain. The whole of my land is what is styled turnip land; but as I do not wish to grow that root so frequently, I grow a large breadth of wurzels, two-thirds of which I leave on the land to be consumed by sheep in the

spring, for the getting up and covering of which I give from 7s. 6d. to 8s. per acre; the other one-third are thrown into small heaps, and covered with the tops, ready for the carts; for this I give from 5s. to 6s. per acre; the carting and clamping are done by the day. Turnips are cleaned and covered, with one-fourth to go off, at from 7s. to 8s. per acre: this price includes the filling of those that are removed. Hand-hoeing wheat is from 3s. to 3s. 6d.; hoeing peas after horse-hoe, 2s. 6d.; beans, 3s. 6d. to 4s.; turnip and mangold hoeing on the ridge, at 24 inches apart, 5s. 6d. to 6s. 6d. an acre; washing and shearing sheep, 3s. per score; mowing grass and clover, 2s. 6d. per acre, with beer. My plan of harvesting has hitherto been to hire the whole of my men and boys, generally at double their ordinary day's pay, with a liberal allowance of beer for the month, thus securing their services. Besides this, however, I let to a company of these same hired men the cutting of the wheat and barley, thus giving them an opportunity of earning more than their day's pay."

I add here a list of prices at which the various operations of the farm may be accomplished under ordinary circumstances either by the piece or by well-superintended day-labourers. It is taken from the "Handbook of Farm Labour." *

	s.	d.	s.	d.
Ploughing per acre	6	0	to 12	0
" by steam "	6	0	8	0
Harrowing (a double turn) "	1	1		
Rolling "	0	8	1	6
Drill-pressing "	1	9	2	0
Grubbing "	2	0	5	0
" by steam power "	5	0	8	0
Paring, by horse "	3	0	4	0
Horse-hoeing corn "	1	0		
" " turnips "	1	6		
Hand-hoeing corn "	3	6	5	0
" " turnips, 3 times "	10	0		
" " " once "	3	0	3	6
" " potatoes, deeply "	8	0		
" " " (earthing up) "	4	6	6	0
Sowing corn (by Suffolk drill) "	1	6		
" " turnips (2-rowed drill) "	0	9		
Dibbling mangold wurzel "	2	6	3	0
" beans "	5	0	6	0
" corn "	5	0	8	0
Hoeing in wheat "	8	0		
Sowing corn broadcast "	0	3	0	4
" clover "	0	2		
Cutting and stooking corn by hand "	7	0	12	0
" " " " by machine "	5	6	7	0
Mowing clover "	2	6	4	0
" grass "	3	0	4	0
" " by machine "	1	0		

* Longmans.

		s.	d.	s.	d.
Haymaking (including mowing)	per acre	10	0		
Pitching corn in sheaves from field to rick	"	1	0	to 1	6
Building corn in rick	"	0	8		
Carriage from field	"	0	8	1	0
Thatching	"	1	4		
Carriage per mile	per ton	0	6	1	0
Harvesting swedes, mangold wurzel	per acre	12	0		
Pulling and filling ditto	per ton	0	3½	0	4
" " carrots	per acre	20	0	25	0
" " potatoes	"	20	0	25	0
Threshing by hand, wheat	per qr.	2	6	4	0
" " barley	"	1	3	1	6
" " oats	"	1	0	1	3
" " beans and peas	"	1	3	1	6
" by steam power, wheat	"	1	6	2	0
Winnowing	"	0	1	0	1½
Digging, turning in	per perch	0	1		
" deeper	"	0	2	0	3
Trenching (two spits)	"	0	8		
Turning dung	per cubic yard	0	0½	0	0½
Filling	"	0	0¾		
Paring (breast plough)	per acre	7	0	15	0
" (horse plough)	"	3	0	6	0
" and burning	"	12	0	30	0
Digging ditch	per cubic yard	0	2		
" drains, 4 feet deep	per perch	0	6	0	8
Live Stock.—Sheep feeding, weekly	per head	0	0½	0	0¾
Cattle, ditto	"	0	7	0	8
Shearing sheep	per score	3	6	5	0

III.—TURNIP CULTURE.

The Swedish and common turnips are still the most extensively cultivated root crops in this island. Notwithstanding the great extension which the difficulties of turnip culture, no less than the excellence of the rival crop, has given to the cultivation of mangold wurzel, nearly half a million acres (one-seventh of the arable land of Scotland), and probably two millions of acres (one-eighth or thereabouts of the arable land of England), are devoted to the cultivation of this crop; and upon its consumption on the land and in the yards depends the production not only of a very large quantity of butcher's meat, but also of the succeeding crop of barley. How very important an influence this plant thus exerts on British agriculture may thus be easily imagined. Our winter store of cattle food would be scanty without it; and the food of future plants, as well as of the live stock of the farm, depends upon the abundance of the turnip crop. Of late years the difficulties both of growing the crop and of preserving it when grown have been very great, and the crop has generally failed. This has been attributed to many causes; but Mr. Spooner, of Southampton, is probably right in attributing it wholly to

peculiarities of the weather. From his valuable essay on this subject in the *Bath and West of England Society's Journal*, we extract the following conclusions. By a reference to the earliest editions of this work he concludes that the turnip crop was long ago just as liable to disease and injuries as it is at present; and by a reference to the weather tables of the last few years he discovers that "the principal cause of the deficiency, of late years, in the growth of turnips and swedes on light calcareous soils, has been the diminution in the fall of rain. This cause has operated the more when, in consequence of its unclean state, it has been found necessary to plough repeatedly, thus unduly exposing the land to the sun's rays. It has also existed when turnips have succeeded tares or other green crops, either fed or mown, the crop itself robbing the land of *some* of its moisture, and the after-preparation of the land during the hottest months depriving it of still more. Where the land has received no ploughing after the autumn, but has been cultivated with the scarifier in the spring, success has generally followed. On soils where calcareous matters are naturally deficient, or have not been recently supplied, in addition to the difficulty of cultivation arising from the absence of moisture, another cause exists, viz., the prevalence of club-foot."

Lastly—"As every plant has its peculiar enemies, so the turnip, by being very frequently repeated, greatly assists in fostering its foes, and thus the land becomes infected with the eggs or seeds of these enemies, which, permitting intervening crops to escape with impunity, attack their peculiar prey at each rotation."

An examination of a number of cases disproves the idea commonly entertained that the increasing difficulty of growing a turnip crop is "to be attributed to the employment of any particular manures—at least, in any other way than by the much greater extension of the root-crop, which the use of artificial manures has enabled agriculturists to effect, and which, as before pointed out, may have assisted in keeping alive the enemies of the crop.

"Neither has it been produced by the deprivation of the land of any particular element by the growth of such roots, seeing that chemistry is altogether unable to point out any body which is not again fully restored to the land by means of manure."

The remedies recommended for diminishing or removing the evils complained of are—

"To avoid the too frequent repetition of swedes and turnips by interpolating a crop of mangold or carrots, but particularly the former.

"To clean and till the land in the autumn as much as possible, and to avoid spring ploughing as much as can be done, by calling in the aid of the scarifier or the grubber.

"To discontinue in part the growing of vetches or tares previously

to the turnip-crop, by which the land is rendered unduly dry, and to substitute an increased growth of mangold wurzel.

"To recur to the plan of liming or chalking non-calcareous soils previously to the growth of turnips.

"To avoid the cultivation of stolen crops, such as stubble turnips, which encourage the enemies of the crop in the same manner as a full crop, whilst only a very moderate amount of food can be expected in return for the risk incurred.

"To use every effort, by good tillage and liberal manuring, to grow a heavy crop of roots, so as to compensate for the number of acres diverted from the production of this crop."

In accordance with these recommendations turnips should not be taken oftener than once in six years on the same field. The stubble of the crop after which they come should be thoroughly cleaned and cultivated, and, if possible, manured in the autumn, and the spring tillage should involve as little as possible of the use of the plough. Of late years the cultivation of the turnip* has been greatly modified by the use of artificial manures. The use of bone dust as a manure for this crop dates from the beginning of the present century, when it was found that on light soils sixteen to twenty-four bushels of bone dust were sure to produce a good crop. Since then the importation of guano, and especially the manufacture of superphosphate to the extent probably of 100,000 tons per annum, has induced the English farmer to depend more and more on these "artificial" fertilizers for his turnip crop, leaving the farmyard manure almost wholly for the crop of clover in preparation for wheat. It is probably not too much to say that one-third of the turnip crop of the country is more or less dependent on superphosphate for its produce. Three cwts. per acre with ashes are a common dressing by itself for the turnip; and if there be a half dressing of dung in addition, it is most liberal management.

It is common to bring the land into tilth and cleanliness by autumn culture, paring and burning and ploughing; and afterwards in spring to pass the harrows over it and the grubber through it, to be followed by harrows, weed pickers, and roller. Then to give it another ploughing, first putting on what farmyard dung it may be intended to apply, harrowing it down and sowing the seed in June along with the artificial manure, either by the common drill or out of a water drill, by which both superphosphate and seed are washed into the ground together. In this case the rows of plants are placed about eighteen inches or two feet apart, and they come up on the flat.

In Scotland and the north of England, as much as possible is done to autumn cultivation, but that in spring is a more laborious affair than what has just been described. It involves probably two

ploughings with sufficient harrowings to clean the land and reduce it to tilth. The land is then ribbed up by the plough at least twenty-six inches apart, a dressing of twenty to twenty-five cubic yards of farm dung is placed in the drills, and the superphosphate or guano, two or three cwts. per acre, is sown broadcast over all, and the whole is covered by splitting the ridgelets. And on the tops of the new ridges—just over the dung therefore—the seed (about three lbs. per acre) is sown in rows in the month of May. The plants are ultimately singled out in the rows to ten or twelve inches apart, and a great deal of the success of the crop depends on the land between the rows being frequently and deeply horse-hoed during its growth. If the ground harden over, and the growth of the plant be consequently checked, the probability is that mildew will attack it, and the plant will stop growing, and ultimately rot upon the ground. But this is work for consideration and superintendence in June and July. The seedtime in the north of England is, indeed, more generally in June, and even in July, than in May; for the earlier sown crop is more liable to disease. And a great deal of the turnip crop in England is dependent wholly on artificial manures—three or four cwts. of superphosphate of lime, mixed with ashes, being sown either with the seed in drills upon the flat, or broadcast and mixed with the soil by harrowing before the seed is sown.

In Scotland, as has been said, the fields for turnips receive a dressing of farmyard, and either superphosphate or Peruvian guano, two or three cwts. per acre, in addition. The land having already been cross-ploughed, harrowed, "cultivated," harrowed, cleaned, and rolled, since winter, the dung is carted on; the heap should be first soaked with liquid manure from the tank. Three men filling the carts, and one man dividing the loads into heaps about five yards apart in the field, and as many boys leading as the carts employed and the distance may require, and two men spreading and three ploughs at work in the field, should fill, carry, divide, spread, and plough in 120 cubic yards of dung on four acres of land in a day. It is well to make the filling at the dung-heap *piecework*, paid for at the rate of $\frac{3}{4}d.$ per cubic yard. Immediately after the ploughing, the land, if dry, should be harrowed, and the roller should follow the harrow in dry weather. The dung is thus put in broadcast: this is better both for the green crop after it has once started, and for the ensuing grain crop; but if the land be not in such condition as that the seeds shall sprout and grow vigorously, though unassisted by manure, then the land, after receiving a half manuring thus, should be ribbed into very shallow furrows about 26 inches apart; in these furrows about 10 cubic yards per acre of well-rotted dung saturated with urine should be spread, the drills being immediately split by the plough again, making the furrows this time considerably deeper. All this goes on at once; that is to say, the field being all manured,

ploughed, and rolled, two ploughs commence ribbing it; when they have got a few drills opened, the carts come with the manure, and go up every third furrow; the horse walks up without stopping, and the man behind with the dung-drag pulls out regularly a portion, so that he shall empty his cart in such a length of three drills as corresponds to one-tenth of an acre; a lad follows dividing what has thus been emptied amongst the three drills, and women or lads with forks spread the manure belonging to each drill evenly along the bottom of each. Six drills may thus be completed by the time 14 or 16 are opened, and the ploughs, instead of merely opening new ones, now go round and round the manure party at work, covering up their work on one side by splitting the old drills, and preparing the ground for them on the other by opening new ones. About three acres may thus be done in a day, and the land is then ready for sowing.

The dressing of artificial manure, when it is applied in addition to farmyard dung, should be sown broadcast over the open drills with the dung in them, and the splitting of the drills will not only cover up the dung, but mix the artificial fertilizer with the soil thus moved to cover it. The seed is sown with a two-rowed turnip drill furnished with rollers and coulter, which flatten the raised ridgelets and guide the seed to its place along the ridge lines; or if sown on the flat it is sown with the common Suffolk drill, supplied with cups adapted to the turnip seed, the coulter which shall deliver it in rows being set about 18 inches apart. It is sometimes sown broadcast on the flat with the same machine that is employed for sowing clover and grass seeds; but this is never good management.

Of late years a water-drill has been employed with great advantage for the sowing of turnip seed. Mr. Ruston, of Chatteris, Cambridgeshire, who advocates their use, says:—

“The mode of working these drills is far less difficult than would be generally conceived. Upon our high land farms we have either open ponds and reservoirs, or pumps supplied by unfailing springs, where ample supplies of water can be procured, and whence it can be carried in a water-cart. Where water is procured from the ditches which surround the field in which the drill is at work, the method adopted is very simple indeed. A large tub is placed at the side of the ditch just where the drill turns out at the end; this tub is kept filled with water, the drill draws up by the side of it, and the men at once, with pails, fill the cistern.”

Not only does the water thus sown in the drills along with the seed moisten the seed-bed and hasten the brairding of the crop, but it is the best possible means of conveying the food of the young plant to the soil.

Mr. Ruston uses the machine, Chandler's water-drill, made by

Reeves, of Bratton, near Westbury, for sowing grain as well as turnip and other seeds. He says:—*

“It has not been my practice to use any kind of liquid manure tanks, such as urine or yard drainage, but simply water, in which I have placed either superphosphate of lime, guano, or a mixture of the two. My general practice is to use superphosphate alone, but in a few instances with oats grown upon wheat stubbles, I have thought it desirable to supply ammonia in some form to a moderate extent, and have consequently sown from one to one and a half cwt. Peruvian guano, mixed with one cwt. superphosphate, per acre. And when this has been done I have had the two mixed together and riddled in some spare building, that the large hard lumps, which are generally found in considerable quantities in the guano, might be thoroughly broken and pulverized before going into the field. But where superphosphate alone is used this is altogether unnecessary. My plan then is, to take the bags of manure, just as they come from the manufacturer, into the field; a man then prepares it for use. He has a wheelbarrow and a fine sieve, with a shovel; he takes the manure from the bag with the shovel, places it in the sieve, and then sifts it into the wheelbarrow; the lumps which will not pass through the sieve he throws into a small tub taken to the field for that purpose; these he breaks until they are sufficiently small. I usually sow from two to three cwts. per acre, and with a 4-feet 6-inch drill sow seven acres per day. One man will sift all the manure, help to fill the drill with water, and, if in a field where the supply can be obtained from the ditches, will also keep the large tub filled with water. In such cases this single man is the only additional labour required by the water-drill over the common dry drill, and, indeed, where the latter is used, some preparation of the manure is necessary. Where the water has to be conveyed a distance, as previously stated, an additional man with a horse will be required, and sometimes a boy also to pump.

“In sowing mangold, coleseed, or turnips, I invariably use only two coulter, which, with a 4-feet 6-inch drill, make the rows just 27 inches apart. Careful and close observation during the last five years has fully and thoroughly convinced me that this distance is in every respect better for either of these crops than three coulter 18 inches apart would be. The horse-hoe can be used freely and frequently, and a stronger and more vigorous plant secured. When sowing any crop, where only two coulter are employed, we use plates in the cistern for the discharge of the liquid, with holes punctured through them from one-half to five-eighths of an inch in diameter; and with these a cistern full of water, which is about 60 gallons, will sow 40 chains, which will give a total of about 220 gal-

* *Journal of the Agricultural Society of England.*

lous per acre. In sowing it is very needful when the drill is full that the holes should not be quite opened, as the flow from the weight of liquid in the cistern is necessarily more rapid than when the quantity becomes lessened; this can be easily managed by the slide, but requires constant attention if the discharge throughout the whole length of the field is to be equal. It can be done, as was proved by my own crop of oats sown last spring. I put in 112 acres with the water-drill, the whole of which came up and grew as uniformly even and regular as could be desired. But, besides the equal distribution of the manure from the drill, there is also needed the equal and regular supply of it to the drill. This is managed by ascertaining in each field into which the drill enters how many rounds the drill must perform to sow an acre. Having calculated this, and knowing the number of half-pecks each bag of manure contains, it becomes an easy matter of calculation to learn how many half-pecks are required for each drillful of water. These are then properly measured and applied, and the object sought is attained."

Mr. Ruston's experience has been invariably in favour of this mode of applying manure and depositing seed in the turnip field—several tons per acre increase of the crop having been almost constantly the result of using the water-drill.

For those cases where home-made superphosphate is preferred to the commercial article, we give the following instructions for its home manufacture, from the pen of Mr. Lawes, who is now the principal manufacturer of the article:—Calcined bones are to be reduced by grinding to a very fine powder, and placed in an iron pan with an equal weight of water (a cast-iron trough, such as are sold for holding water for cattle, will do); a man with a spade must mix the bone with the water until every portion is wet; while the man is stirring, an assistant empties at once into the pan sulphuric acid, 60 parts by weight to every 100 parts of bone; the acid is poured in at once, and not in a thin stream, as commonly recommended; the stirring is continued for about three minutes, and the material is then thrown out. With four common farm labourers and two pans, I have mixed two tons in one day. The larger the heap that is made the more perfect the decomposition, as the heap remains intensely hot for a long time. It is necessary to spread the superphosphate out to the air for a few days, that it may become dry.

To the use of lime in the prevention of the disease called an-bury, or club-foot, to which the turnip crop is especially liable, reference will be made hereafter.

Rape may be sown in early May for consumption by sheep towards July. The land should have been prepared as for turnips, and the seed may be sown about 4 or 5 lbs. per acre, in rows 18 inches or thereabouts apart, by the water-drill, upon the flat.

The cultivation of mangold wurzel in the month of May includes both the sowing of the later part of the crop in the beginning of the month, and the horse-hoeing and singling of the young plant in the case of the earlier sown fields. The mode of doing both has been already described in p. 227. I will therefore only add in reference to mangolds, swedes, turnips, and all other farm seeds, that it is of the greatest importance to secure these from plants of a true sort, and from well-grown plants of that sort. Nothing is more clearly determined than that plants inherit tendencies and qualities as much as animals do from their progenitors; and while one which has descended through a number of generations, all of the best style of growth, is certain to turn out a credit to its ancestry, another of more mongrel descent is likely to degenerate towards the natural type of the plant.

The carrot and parsnip crops will probably need hand-hoeing this month; or horse-hoeing if the interval between the rows be wide enough. And the young plants should be singled out to intervals of about eight or nine inches.

Potatoes.—Some time during May the early-planted potato crop will require a hand-hoeing, which should be done with great attention, that not a weed may be left, the surface of the land being left well cut, and in fine order. Crops put in by horse cultivation, being in rows from end to end of the field, should receive, besides this hand-hoeing, the first horse-hoeing, which should be given with a small one-horse plough first turning a furrow from the row of plants towards the middle of the interval, and afterwards with a common horse-hoe, to which reference will be more particularly made hereafter. The harrow appendage to the horse-hoe may be removed if the object be merely to stir the land, and unless there be a crop of weeds to be moved and shaken from the earth.

Cabbages.—The crop of cabbages planted in April will require a hand-hoeing this month. It should be given only to the tops of the ridges, about eight or nine inches around the plants: the weeds should be cut up clean, and loose mould drawn to the stems of the plants. In about ten days after, the first horse-hoeing should be given, turning a furrow from the plants, and throwing up a ridge of earth in the middle of each interval. This operation will be of great use: it lets the atmosphere into the ridges on which the plants stand, and consequently sweetens and meliorates the soil; and it kills the weeds that grow on the sides of the ridges much more cheaply than it can be done by the hand-hoe; it likewise pulverizes the earth taken away, and brings it into fine order for returning to the plants in June, when they will strike into it, and thrive the more.

The common culture of this plant, every one knows, is that of sowing the seed on a seed-bed, and transplanting where to remain;

but some adopt the practice of drilling the seed at once the beginning of this month where the crop is to remain. This saves the expense of transplanting; though that is an object of very small consideration. It is true, there is one object in which this system is inferior to the common practice; from February till June is gained for a fallow in the usual culture; but not *equally* in this new method. It is therefore to be recommended, not to practise it on foul land; but in fields tolerably clean it may be safely executed: and perfect safety is attained if the cabbages follow some other fallow crop, as turnips, tares, beans, &c. The seed should be drilled as for turnips on ridges, upon good land, a yard broad: the manure being laid in the furrows, and the ridges reversed for covering it.

Lucerne may yet be sown in the early part of May. Drilling is better than broadcasting, just as the hoe is better than the harrow for keeping the crop clean. If drilled at nine inches, it might once a year be most effectively horse-hoed, which would eradicate grass far better than any harrowing that could be given to a broadcast crop, without a formidable expense, and some danger of damaging the crop, tough as the roots are. The grand object in the preparation of the ground is to have it as free from weeds, and especially grass, as skill and perseverance can effect. The crop of the preceding year should have been turnips fed on the land by sheep, before the Christmas frosts; the field immediately ploughed, and laid by that ploughing ready for broadcasting or drilling. In March it may have been scuffled on the surface, and in the beginning of April in a dry time, sown. This may be done with or without corn; if drilled, it will be better alone; if broadcast with barley or oats, under-seeded: but it may be drilled with corn; the corn first broadcast, and then the lucerne drilled among it; or the corn may be drilled, in one direction, and the lucerne afterwards across it. Not less than 12 lbs. an acre should be drilled, and 20 lbs. sown broadcast. It is apt to be eaten by the fly, but if it escape that damage, all is safe, and the farmer may be assured that his care will be well repaid. No manuring at this period is necessary: but to sow soot just as the young lucerne is got above ground, may be beneficial against the fly. In regard to proportioning the quantity of land thus occupied to the stock intended to be fed on it, a quarter of an acre per head is sufficient for all sorts of large cattle, taken one with another, if the land is very rich and good.

IV.—PARTICULAR CROPS.

Hemp.—Early in this month is the season for sowing hemp. As it is an article in which the farmer produces a raw commodity for the use of the manufacturer, he is liable to suffer if he does not

move with caution where it is not the common husbandry of the vicinity. Before, therefore, he ventures on any such articles as hemp, flax, woad, madder, &c., let him most carefully ascertain his market, and the variations of price the commodity is usually liable to; and, if he cannot contract for the sale, he should be cautious of engaging in the cultivation. It may be twenty to one whether he has anything like an open market to carry his product to; and if he has not, he may find a crop on his hands, easily sold, but not perhaps at a fair price. The profit of cultivating hemp, in *hemp districts*, is not inconsiderable; but other circumstances demand attention.

It requires the very best land to be found on a farm, or which is made such by manuring: a deep, friable loam which cannot be too rich. It further demands ample manuring; that is, from thirty to forty cubic yards per acre. It is true that it will pay for this dung, but every one knows that in calculations there is apt to creep in (in the point of charging dung) some degree of fallacy. Wherever it is spread, there, probably, will be the greatest profit; and if hemp, hops, madder, &c., rob the more common crops of dung, which, but for their culture, would be disposed of otherwise, it is no easy matter to charge them for it sufficiently high. Another very material circumstance is, that hemp returns nothing to the farm wherewith to raise dung: corn gives straw, and green crops swell the dunghill; from hemp the farmer gets nothing of this sort.

The land should, from the preceding autumn to the time of sowing, have two ploughings; or two and sufficient scuffings, and be harrowed to a fine surface.

Dung should be amply applied, in proportion to the deficiency of the soil of fertility; but the crop is never ventured on any land without a good dressing.

The quantity of seed to be sown per acre varies according to the practice of different individuals, and of different districts, from ten to twelve pecks.

It is sown broadcast; nor can I see any motive for drilling a plant which utterly destroys weeds, except one, that of burying the seed at an equal depth. Should any person be inclined to drill, the rows should be near to each other.

Gorse.—The value of gorse as a forage plant is well known, although its cultivation for that purpose appears to have been almost entirely overlooked, or to have had much less attention paid to it than it is justly entitled to. From time immemorial it has been used as food for cattle in various parts of the kingdom; but it is only the smaller class of farmers in England, and the cotters in Scotland, who resort to it, as a means of prolonging the little stock of fodder that they may have stored up for their winter supply. To them it is of no small importance, and the avidity with which it is eaten by cattle

and horses, after being prepared, shows very clearly that it must possess some valuable qualities which would almost render its cultivation desirable.

It grows to perfection on upland dry and hilly districts. In all cases, whatever may be the nature of the land intended for furze, it is desirable to have it pretty well prepared previous to putting in the seed; for, although no plant requires less attention during the period of its growth, it is advisable at first starting to give it a little kind treatment, such as getting the ground broken up if possible, early in autumn, and exposing it during winter so as it may become friable and well pulverized by the time of sowing the seed. Instead of applying manure, nothing answers better than burning the grassy lumps along with any faggots of old brambles or furze which may have been cut from the waste before it was broken up, and then spreading the ashes equally over the ground either before they are cold, or as soon after as may be convenient.

With respect to the time and method of sowing furze, there seems to be some difference of opinion, but it may be regarded as certain that the fittest period, under all circumstances, is the spring; about the latter end of March, or beginning of April, after the principal corn crops are sown. When deferred until May or June, they will undoubtedly answer tolerably well, but it is not advisable to delay the sowing so long if it can possibly be done earlier. The common practice is to take a crop of oats the first year from off the land, in which case the furze is sown broadcast immediately after the oats, and both harrowed in together the same as clover and grass seeds. A better plan, however, in situations where the ground will admit of its being done, is to sow the oats, and then drill the furze seed in rows a foot apart, and afterwards brush or cover them with a light harrow. This will be found superior to sowing broadcast; less seed will be required, and, what is of far more importance, the vacant spaces between the rows may be cleaned after the corn has been cut, and some fresh soil, if necessary, drawn to the plants before winter, which will be of great service in promoting their growth, and at the same time prevent them from being drawn up by the frost and destroyed.

The quantity of seed required for an acre will vary according to their quality, and the mode in which they are intended to be sown. If broadcast, and the seed can be depended on as being fresh and good, from six to eight lbs. per acre may be reckoned a fair average; but if in drills, little more than half the quantity will be sufficient. The usual cost of the seed ranges between 1s. and 1s. 6d. per lb., which is of little importance when compared with the loss of a crop. On this account, therefore, it is desirable to sow rather thickly, so as to avoid the chance of failure, by saving the price of a few extra pounds of seed.

Chicory.—This most hardy plant will do well wherever sown. It is indigenous over the greater part of the kingdom. On poor barren, blowing sands, such as many districts abound with, especially in Norfolk and Suffolk, it will yield a great quantity of sheep food. Upon such soils, when they want rest and recruiting, it will, if sown with cocksfoot grass and burnet, form a layer for six or seven years, keeping so many sheep as materially to improve the soil. On fen and bog lands and peat soils it thrives. On all land, whatever the soil, on which clover, from having been too often repeated, is apt to fail, chicory may be substituted. It does very well for soiling cattle, both lean and fattening. It is of excellent use for those who keep large stocks of swine, whether by soiling or feeding in the field. It does exceedingly well in an alternate system of grass and tillage, as it will last four, five, six, or even more years. Objections to it have been made by reason of its rising, and becoming a vivacious weed, in succeeding crops. If the circumstance be not guarded against, this will happen; but who ventures to forbid that culture on account of this quality, which is really founded on its merit? Chicory may be sown broadcast, among spring corn, in the same way that clover is sown; or drill it at nine inches on poor land, and at twelve on better soils, in order to give it now and then a scarifying; the first for feeding, the last for soiling. From twelve lbs. to fifteen lbs. of seed per acre is the proper quantity. One harrowing after sowing is sufficient. It should have been sown in April.

Buck-wheat may be sown towards the end of the month. So late a time has offered the opportunity of good tillage to destroy weeds, and of course the land is fine, and in good order. It is a profitable crop on poor sandy soils, that either require late sowing, or that you are disappointed in the design of sowing soon enough for barley. Late sown crops of the latter grain seldom pay expenses: in such cases, it is useful to substitute buck-wheat; for there are many soils on which a crop of buck-wheat, sown in May, will exceed in value a crop of barley sown in May: yet, in many tracts of country, it is a common custom to sow barley as late as that season. A bushel of seed per acre, broadcast, is an ordinary seeding.

The Lupine.—Mr. Crisp, of Butley Abbey, states of this crop, in the recent number of the *Journal of the Agricultural Society*—

“In 1858, I drilled about one bushel per acre of seed, upon eighteen acres of poor land; from which I obtained fifty waggon-loads of sheaves. The luxuriance of this crop quite astonished all that were acquainted with the sterility of the soil; and the quantity of grain, before harvesting, was estimated by various persons at from forty to fifty bushels per acre.”

The seed was, in this case, obtained from Baron Herm. von Nathusius, of Hundisburg, Prussia, who, in the same volume, describes the plant and its cultivation. He speaks of both the blue

and yellow lupine as cultivated for the purposes of being ploughed in as green manure, of being folded over with sheep while still succulent, and of yielding a crop of seed which is of great use as food for sheep. "What makes these plants so very important for agriculture," he says, "is their growing luxuriantly on light, poor, sandy soils, in situations where no other of our leguminous plants could live. We have some districts in the northern parts of Germany and Prussia where a miserable crop of rye was nearly the only production, and where even buck-wheat would fail in dry seasons; and it is in such situations that farming has become profitable by the cultivation of the lupines, and where, in consequence, the rent has been much more than doubled. For such poor dry land it has been proved a good plan to sow the yellow lupine (especially this because it is more succulent) in June; to roll it down when it is in full flower, the first pods beginning to show; to plough the field, and to sow a corn crop some weeks after ploughing, and very often a better crop has been raised than after manuring with cattle-dung, a stuff of course not abundant in such poor situations. There may be some conditions when such a manner of 'green manuring,' as it is called, may be advisable; but, generally I think it a much better plan to fold off the plant with sheep, which, not at first, but after they had been accustomed to it, are very fond of the yellow lupine in this state, and thrive remarkably well on it. If the seeds are sown in spring, which we here dare not do before the end of April or the beginning of May, sharp night frosts being destructive to the young plant, the vegetation is slow in the first weeks, but it soon becomes very rapid. In the poorest soil, if any rain falls, the plants grow to the height of three or four feet, and a great quantity of beautiful flowers cover the whole field. The seeds of the first flowers begin to ripen when the top of the plant is still blooming, and for that reason the plant must be cut before finishing its growth; even then there is always some loss of seeds, the ripe pods being very prone to open by the heat of a sunny day."

An analysis is given of the air-dried seeds, showing that they are particularly rich in nitrogenous substances. The cultivation is something like that of rape. Drilled in May at the rate of one or one and a quarter bushel per acre, in rows twelve inches or more apart, so as to enable the use of the horse-hoe until the plants meeting keep the ground clean, it yields a crop of six or seven quarters per acre.

"The seeds of both varieties form very superior food for sheep, lambs, and fattening wethers. After they had been weaned to it, I have often seen them refusing cake if they had plenty of lupines. The straw and chaff is excellent for store sheep. It has been found by many persons that lupine hay, straw, and corn, are in some degree preventatives of the rot, and even sometimes remedial, if the

danger is just beginning and the disease not far advanced. We know of no other plant which, generally speaking, is so peculiarly adapted for sheep.

"The seeds have been used for horses and cattle, and undoubtedly it has been found profitable to mix them with oats or beans; but they generally refuse a greater quantity. Some small farmers now begin to give lupine-meal with milk to the weaning calves, and they are said to do well, and that the grown cattle afterwards are fond of the plant. Swine generally refuse them, and some experiments to extract their peculiar bitterness by water or chemical agents have not succeeded."

Baron von Nathusius adds of the crop :—

"There is no doubt that it is a real boon for the poorest sandy and gravelly soils; but for soils of a better description it is no less a very profitable plant."

Holcus Saccharatus.—A good deal was at one time expected from this plant for yielding sweet forage; but the experience of a cold summer has proved that it is entirely unsuited to our variable climate. In the hot summers of 1858 and 1859, a large produce of stem and leaf, full of sugar, was obtained from it late in the season. The following was the history of a plot, as given in the autumn of 1859, in the *Agricultural Gazette* :—

A patch of about a quarter of an acre was sown in soil of a tolerably good depth, resting on the brash of the great oolite, the previous crop having been potatoes. The only manure employed was ashes from burnings of roadside parings and the refuse of hedge-rows. The seed was drilled on the 13th of May, in rows fourteen inches apart, and at a depth of about three inches; it came up very well and evenly, and through the summer went on growing very luxuriantly, and its large flags presented a most handsome appearance.

Another plot was sowed on forest marble clay resting on the great oolite, ashes from garden refuse being the manure. The distance apart was in this instance twenty inches, depth not more than three inches. This came up soon, and for the first month did not at all promise the fine aspect it afterwards showed; but as soon as the warm nights came on it made rapid growth; and we were thus led to infer that too early sowing is by no means a saving of time. In this, as in the other case, the crop was hoed; but this is a delicate operation, as it sends out adventitious roots from the joint immediately above the ground, which dip into the soil, and, if not interfered with, aid immensely in forwarding the growth and development of the plant. When the new roots are fully established, a careful stirring of the ground between the rows, not between the individual plants, appears very much to facilitate a larger, and, what is more important, a quicker growth. Thus, then, have we brought up the

history of both plants until about the middle of August, when trials were made of the feeding properties of the field crop, or rather of the tastes of cattle in regard to it. Food parcels of the whole plant were cut close to the ground, and carried at once to the farmstead and tried, with the following effect:—

Horses would not touch it.

A two-year old bull ate it greedily, and could scarcely be induced to eat anything else.

The milking cows partook of it very sparingly.

The pigs had no prejudice with regard to it.

The most forward parts of the crop were at this time intensely bitter, and we began to fear that the cold climate of at least some part of England was inimical to the development of the saccharine matter which this plant is known to possess when grown in warm climates.

In September we again employed the trial by taste, and in the larger or central stalk we then found a great change; this had become very sweet, and the cows then partook of it at least with an apparent relish; but while this was so with the principal or main stem, the stolons or side shoots were still bitter, and it was not until October that the major part of these became sweet.

It was plain that it does not all ripen together: the central or oldest stem is perfect before the lateral shoots, so that while this is sweet, those are even intensely bitter; and if we wait until the sweet matter is developed in all, the central stem will by that time be so hard and woody as not to be capable of being used as a cattle food; hence we advise that the central stem be the first to be gathered. This can easily be done by boys, who can readily detach it with some kind of knife; and this done, the other shoots will at once make accelerated growth, so that, by adopting this expedient, we have a better chance of deriving the full benefits from the whole of the crop.

As regards the amount of the crop our calculations founded upon the results of the smaller experiment would lead us to infer that the weight per acre in the second week of September was somewhere about fifty tons to the acre, and the farm produce seemed to us to be very nearly of the same quality and quantity.

Last year (1860) with its cold season was entirely fatal to the crop, the seed of which hardly even sprouted; and it is plain that the plant belongs to a country of hotter summers than can be expected here.

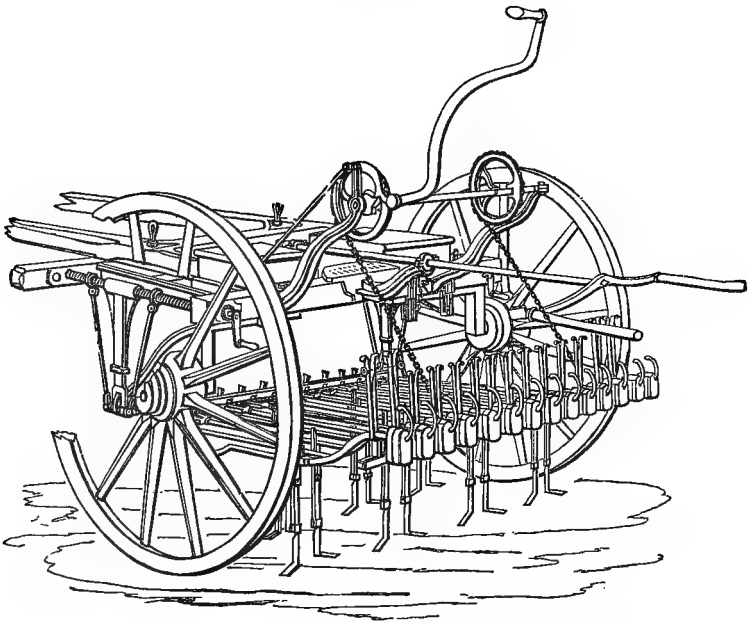
The Hop garden.—The poling and subsequent hoeing of the hop grounds are now completed. They are now dug a second time. In some few grounds the tying is just commencing; this operation is performed by women, who usually tie three bines to each pole with rushes. Each woman takes about four acres under her care,

which she superintends till the vines have grown out of her reach, tying them to the poles as occasion requires.

V.—GRAIN CROPS.

All grain crops which need it may receive a last hoeing in the month of May. Where clover and grass seeds have been sown, of course hand-weeding is the only cleaning process that can be adopted; and on other fields, where the plant is forward, hand-hoeing carefully performed is alone possible; but on backward fields in May, as generally in drilled crops in April, the use of the horse-hoe is both cheaper and more efficient. Fig. 34 is a drawing of Garrett's

Fig. 34.



Garrett's Horse-Hoe.

corn horse-hoe, the original now of many such machines made by different manufacturers. The implement represented is a seven-rowed hoe; it is provided, as will be seen, with a lever handle, by which the whole framework of hoes can be lifted out of work, and also with a double handle, between which the man walks, by which the whole framework of hoes can be shifted laterally. Various other capabilities of adjustment to its work are provided, and the

whole is an exceedingly clever and ingenious implement. The hoes clean as many rows at once as were sown at once, and travelling at each time over the same breadth as was accomplished by the drilling machine, all the rows it cleans are parallel to one another. Any deviation exhibited by one is partaken of by all. The driver therefore looks on one row only, and taking care, by the guidance of his tool, to preserve it uninjured, all the others are secured.

Mowing Luxuriant Wheat.—Forward crops, with a great quantity of broad leaf, are liable at this season to be laid by heavy rains. Our best crops at this time of the year completely hide the ground, owing to the luxuriance of their growth. This does no harm in dry weather, but the leaf hides not only the ground, but the stem of the plant, so that it is liable to become blanched, and to be weak and over-succulent. After a shower at this time of the year, when every leaf is bowing under the weight of rain-water, on looking towards the sun at a promising field of wheat you will see its light reflected towards you in an unbroken sheet, none of it finds access to the lower parts of the plants—the leaves get it all to themselves, and, as a consequence, they grow luxuriantly, increasing in length, and breadth, and weight, until, with the load of water which the weather sometimes lays upon them, they ultimately become too heavy for the weak herbaceous stalks below them, and plants are laid flat on the ground, to the great injury of the farmer. It is a common practice to sow salt over too rich land in wheat in early spring, or at seedtime, under the idea that its soda will enable the extraction of the silicates of the soil, and consequently induce the deposit of a large quantity of silica in the straw of the ripened crop, which will thus be better able to stand. It is however certain that this process is effected, if at all, towards the harvest time, and that salt does little or nothing to remedy this liability to being laid early in the season. The only remedy, then, is to induce the hardening and wood-making process in the stems of plants. Now, the deposit of carbon, in which this essentially consists, takes place only in the sunshine. The carbonic acid of the air is absorbed by leaves and decomposed in the sunlight, its carbon being deposited wherever the sunlight falls, and the oxygen being given back to the air. Any growth in the shade is thus more or less blanched; and while one immediate advantage of mowing off the heavy flag of wheat at this time of the year, or earlier, consists in the plant being at once relieved of a heavy overhanging weight which bears it down, the chief advantage is, that the light has leave to play upon the soft and succulent stem of the growing plant, which thus becomes carbonized and hardened, and enabled better to withstand the weather. It is easy, by examining a plant very early in the season, to ascertain the position of the young ear, and the flagging may be easily done without injury to it, either by hook brandished horizontally to

right and left, or, even when the plant is very thick and very succulent, by the scythe. The necessity of a hardened stem, and of letting sunlight play upon it, is an argument for thin sowing at wide intervals: but the consideration of this subject must be postponed till October—the seedtime of the wheat.*

Beans will receive a horse-hoeing in the month of May; and in forward crops, as the last operation with the horse, a moulding up of the rows, where the interval is wide enough, by drawing a double-mouldboard plough down them, is a beneficial operation.

VI.—LIVE STOCK OF THE FARM.

Horses continue to receive a full allowance of the most nutritious food during the long days of hard work which April, May, and June give them. We give in the following page an enumeration of various dietaries, corresponding to a list given for the winter season, in p. 58. They describe the practice of different men in various parts of the country. It is to be understood that an *asterisk* (*) by any of the figures intimates that the grain was crushed, or the green food cut into chaff; and a *dagger* (†), that the roots were given boiled or steamed. It is a capital practice to cut rye, as soon as fit, into chaff along with hay or sweet straw, and mix the whole up with crushed oats and beans, giving the whole thus mixed in small quantity at a time, and thus gradually accustoming cattle to their change from dry winter food. Vetches cut when young should be allowed to wither before being used in the stable, otherwise they prove at first to be physic rather than food.—Mares may be served as they come into season.

The Dairy.—The following, relating to the work of May, from the pen of a Gloucestershire dairywoman, is one of a series of papers communicated by her to the *Agricultural Gazette* many years ago:—

The work of the dairy can now be conducted with regularity. The calves not being expected to interfere with it, as in all well-regulated dairies they are now old enough to do without much milk, and the cows having the advantage of pasturage, the cheese is expected in this month to be of prime quality. If any of the cows should be late calving, their milk should not be used for cheese for at least a fortnight, new milk always having a tendency to make it heave. Cheeset† is now made twice a day. The cheeses pass through three presses in order, advancing a step in their progress at each meal or making, till at last, in four or five days, they come out of the presses, and are put upon the shelves. They are generally salted twenty-

* Carter's "Vademecum."

† This describes Gloucestershire management. Cheddar Cheese-making is described at page 242.

THE WEEKLY FOOD OF A FARM HORSE—SPRING AND SUMMER.

No.	Name and Address.	Hay.	Oats.	Beans.	Roots.	Sundries.	Pasture.	Weekly Cost.
		lbs.	lbs.	lbs.	lbs.	lbs. Potatoes. 70+ Linseed. 3½	lbs.	s. d.
THE SPRING SEASON.								
1	Professor Low—Elements of Agriculture.....	140	73	.....	.....	.....	lbs.	9 9
2	— Binnie, Seaton—Highland Soc. 1850.....	84	70	.....	500+	.....	ad lib.	9 9
3	J. Twynham, Botley Farmers' Club.....	112	84	16	.....	.....	.....	10 3
4	R. Baker, Whittle, Essex.....	70	80	30	.....	.....	140	9 0
5	T. P. Dods, Hexham.....	ad lib.	120*	.....	Carrots.	.....	.....	10 6?
6	— Baldwin, Glasnevin.....	147	98	.....	49	.....	.....	11 6
7	C. Howard, Biddenham.....	ad lib. ½*	42	.....	Green Rye.	ad lib. ½*	.....	7 6?
8	A. S. Ruston, Isle of Ely.....	ad lib. ½*	84	.....	.....	ad lib. ½*	.....	10 0?
9	A. Simpson, Beaulieu, N. B.	168	70	14	.....	.....	168	10 0
THE SUMMER SEASON.								
1	Professor Low—Elements of Agriculture.....	.....	35	.....	.....	Cut Clover.	.....	5 0
2	H. Stephens—Book of the Farm.....	.....	.....	.....	.....	1400	Night.	8 2
3	J. Gibson, Woolmet—H. Soc. 1850.....	.....	50	.....	.....	ad lib.	.....	7 6?
4	— Binnie, Seton, ditto.....	.....	70	28	.....	5s. 3d.	Night.	9 0
5	— Thomson, Hangingside, ditto.....	.....	84	48	.....	ad lib.	.....	11 0?
6	— Barthropp, London F. Club, 1853.....	.....	.....	.....	.....	ad lib.	.....	9 6
7	J. Morton, Whitfield Farm, 1843.....	.....	70	.....	.....	3s.	.....	6 9
8	W. C. Spooner, Journ. Ag. Soc., vol. ix. p. 274.....	.....	42	.....	.....	7 cwt.	.....	8 9
9	T. Baldwin, Glasnevin.....	.....	35	.....	.....	5s.	.....	8 0
10	J. Coleman, Cirencester.....	.....	42	.....	.....	700	.....	6 0
						ad lib.	.....	6 6
						.....	Straw.	
11	J. Cobban, Whitfield.....	.....	42*	.....	.....	ad lib.	Night.	6 9?
12	E. W. Moore, Coleshill.....	.....	63	32	.....	Pasture.	.....	10 6?
13	S. Rich, Didmarton, Gloucestershire.....	84*	31½	.....	.....	Night.	2 acres.	7 6?

four hours after they are made, though this is done by some at the end of twelve hours; the cheese after this is returned to the vats and put under the press, care being always taken, according to what has been said, to put the newest cheese lowest in the press and the oldest uppermost. The brine, which drops from it when in the last press before it is taken out and placed on the shelves for drying, is quite clear; the quantity is small, and it ought to be put into the rennet-jar perhaps every two or three days, which keeps up the quantity, and is thought an improvement to the cheese.

When the cheeses are taken from the salting-presses they are put on shelves in the dairy for a day or two, where they are turned once in twelve hours. They are then taken to the cheese-loft to make way for the new ones. In the cheese-room they are turned once every day; and in general in a month, or less in dry weather, from the time they are taken out of the vat, they are ready for scraping. This is accomplished with a common knife, first moistening the cheese with a wet flannel, and must be done carefully all over the cheese so as to take off the roughness that may be left upon it from the cloth or any other cause, leaving it quite smooth on the surface and sharp at the edges; the sooner this can be done the better. In order to get cheese into a state of forwardness for the factor, it will only require wiping round the edges and an inch within them once a week after this scraping; and it should be turned over twice a week, or even oftener in damp weather. Care should be taken to allow the blue coat to remain on the top of the cheese; this blue coat is considered a sign of richness by the factors. In some districts it is customary to paint the outside of the cheese with Indian red; this should be mixed with warm water to a thin paste and rubbed on with a piece of flannel, and should be done immediately after the cheese is scraped, before any grease arises upon it, and the same treatment should be adopted as if not painted. In most cases it is better to postpone making thick cheeses which weigh about four or five to the cwt. till at least the month of June.

Food for Cows.—The milking cows by this time may be turned to the most forward grass in the richest pastures, and as their supply of this food must be variable, depending very much on the season being a forward one or otherwise, a good dairy farmer should provide a supply of rye or Italian rye-grass, so that a little given in the yards when the cows come to be milked will give them abundance of green food, as it is found they refuse hay. Even when they have not a full supply from the pastures they will not readily make a good meal of dry food after tasting the green; and if it is not sufficient to satisfy them, they roam about restless and uneasy, and of course fail to yield anything like a full supply of milk; and as the produce this month is considered very good in quality,

the quantity should be by all means secured to be as great as possible.

It is of great importance that good water should be supplied to dairy cows. A stream that has been some little while exposed to the air after rising from the spring before running through their pastures, is considered the best water, and the drinking place should have the soil removed and filled with clean gravel or sand, so that the water may pass through pure and fresh. Cows much prefer drinking from a narrow trough or hole, and are shy of going to a large surface of water, though there should be abundant access and egress to and from the watering place, or the master cows will often damage the others in meeting them.

Food for Calves.—The weaning calves should get fed now as described last month, the only difference being in the case of the older ones, which may be gradually getting a diminished quantity of linseed or oatmeal; this of course being less needful for them as they become stronger and more able to eat other food provided for them. They should have a sunny field to run in by day, with some grass to pick from it, but through this month it has been found that they do better on finely-cut swedes or mangold wurzel and good hay, on which they will feed plentifully, having the moisture of a little skim-milk or the mixture of linseed or oatmeal, which, though much diminished in quality, should be given a little warm, though it should become gradually cooler as the calves get older. Should grass be supplied at this time as their staple food, it is found to produce too great looseness in the bowels, to which calves are particularly liable, and carefully guarding against this is very essential to their starting into strong growth. They have been found to do far better in small numbers together, on account of their great disposition to feed and lie constantly very close together; and their readily taking any infectious disorder renders careful attention to what may appear trifles in the rearing of calves very desirable. A strong, healthy herd of dairy cows, which have been proved to be far more useful and profitable when weaned or reared on the farm than if purchased at market, and brought on the farm at almost any age, will be thus obtained. They should have warm sheds by night, in which to receive their hay and roots, and it has been found a very good plan to tie them up to give them their milk, as it makes the animals quiet, and each one then gets its proper quantity undisturbed; and if convenient to allow them to remain tied for a short time afterwards until they like to eat their hay after having their liquid food, all the better; as it prevents their sucking each other's ears or skins, which is often productive of much harm.

Swine.—It is calculated that about one pig can be reared on the sour whey for every two cows in the dairy. Supposing a dairy to consist of fifty cows, three breeding sows, reckoning that each one

would have eight young pigs, might be kept, giving them a run in any rough grass under orchard trees not much used for other purposes: their pigs receiving as much of the sour whey as they will drink, will make strong growing pigs. The whey is much better for pigs' food when old, or at least some mixture of it should be so; and if it be used daily from the vat, which is as often getting replenished from the dairy, it makes a very wholesome drink for pigs, on which they will grow and do remarkably well. And as the pigs are small to begin upon it, and do not drink so much as afterwards, a stock collects for their larger appetites, and this with the wash which large farm-houses must supply, with garden refuse thrown in it in the summer in addition, is found enough to keep the number of pigs mentioned, viz., about one of the age and description given to every two dairy-cows in milk.

Fattening cattle are by this time disposed of, and their places in the stalls refilled. Mangold wurzels and cut forage, along with cake or meal, may be the food of the last off. The new ones will probably receive green food, vetches, clover, Italian ryegrass, or lucerne, and mangolds, without much other richer food, until they have taken kindly to their circumstances, when rape cake, or cotton seed cake, or meal and cut chaff may be steamed together and given to them at the rate of three lbs. to six lbs. of the cake daily, according to their forwardness and size. Grazing cattle are turned out towards the end of the month, when grass affords a sufficient bite.

The Flock.—The lambing season is now over. The castration of the lamb should be attended to when it is about a fortnight old, and in the later seasons of the hill districts of Scotland, much of this operation, especially in the case of the black-faced breed, is accomplished in the month of June. Ewes should be well treated on the pastures, receiving cut mangolds, and a ration of cake or corn, oats and peas daily, until there is a full bite of grass; and the lambs are well grown, and able to help themselves.

The months of April and May are the great selling time for fat lamb. The management of the flock to this end has already been fully described. We add the remarks of a correspondent of the *Agricultural Gazette* of many years ago on the state in which it is best to give certain feeding materials. When peas are given to lambs it is desirable that they should be cracked, not ground into meal; for in this state it is not only objectionable to the lambs, but very wasteful, particularly in damp weather, as much of the finest portion becomes clotted and distasteful, and consequently, useless for the purpose intended. It is therefore only necessary that the peas should be broken, and this only up to the time of the lambs being two months old, for after that period they will readily eat them whole.

Good hay may be given to ewes and lambs, either entire or cut.

into chaff. Fattening sheep (and particularly lambs) should receive their hay in the ordinary state, for they will then have the opportunity to select the best, and leave a portion, and afterwards it may be removed and given to the ewes or other stock; whereas if the hay be given in the state of chaff, the lambs cannot so readily select the best and the clover leaf portion, nor can it be made so available for the removal of the residue to other stock.

The selection of feeding materials is a matter of the greatest importance; for instance, it is commonly considered that white peas are the best for feeding lambs, but my experience has taught me that the grey or maple varieties are much better than the white. I had an excellent opportunity of proving this a few years ago; being out of the grey peas, which I usually grew for feeding, I was induced to purchase some of the best white boiling peas. About a week after I commenced feeding with them, my lambs, which had heretofore given good satisfaction, were now complained of by the butcher; nor did they die well, and in good condition, during the whole time they were eating white peas. But, after a while, I fed them again with maple peas, when the lambs soon regained their former good quality, and maintained it until the end of the season. It may be considered that the astringent property of the grey and maple pea acts favourably in connexion with oilcake, by conducing to the production of a good proportion of muscle and flesh, which is really essential in making up lambs of the best quality. Beans are not good for feeding lambs, as they contain the astringent property in excess of the peas, and I have known, by their use in feeding, that the flesh has been made so hard as to render it unsaleable as lamb.

There is also a vast difference in oilcake for feeding purposes. The home-made and some of the Marseilles cake are very good for feeding ewes and sheep stock in general; but the superior sort of American cake is certainly the best for feeding lambs. This cake, when good in quality, always makes a higher price than other sorts of oilcake; yet it is much cheaper for the feeding of lambs, if we measure its value by results. In fact, I do not hesitate to state that so far as cake and corn are concerned, American barrel cake and maple peas are the perfection of lamb food.

In the growth of grasses intended to produce hay for feeding this kind of stock, it is desirable to select white Dutch clover with trefoil, and a small portion of Italian rye-grass mixed for the lambs; and broad clover with trefoil, and Italian rye-grass for the ewes. The former being intended as hay for the lambs, should be cut very early indeed; it will then, if well made, contain the greatest amount of nutrition; and this is especially necessary, because young lambs cannot under any circumstances be expected to eat more than a limited quantity. It is therefore requisite that the hay should be

of the best quality; for not only will they be induced to eat the greatest bulk of the material, but at the same time the largest possible amount of nutrition will be conveyed into the system. The hay best calculated for feeding the ewes is, without doubt, the same as has been recommended for the lambs; but it often happens that a sufficiency is not grown to feed both with the same sort during the whole season. It is usual to grow the clovers alternately, therefore the supply of either description is somewhat limited, and the broad clover and rye-grass hay is commonly resorted to for the feeding of ewes.

It has been previously recommended to feed the ewes with a certain quantity of oilcake each per day; it was, however, omitted that they should receive half a pint of beans also, in addition, during the last month of their fattening; this will render the flesh more firm; and they will sell better in the market, inasmuch as the great objection to ewes which have been fattened during the time they suckled their lambs is that they are usually deficient in firmness and quality of meat. One great advantage of high feeding for the ewes is, that the lamb is found to participate in it. The extra quality of the milk induced by feeding upon highly nutritious materials verifies the old saying, "a fat ewe makes a fat lamb."

Sheep-washing and sheep-shearing, which have been carried on all through the spring as regards fat sheep sold weekly to the butcher, are now carried out upon the great scale, the end of May being the chief time for the operation in the southern part of this island.

Swine.—The sow put to the boar in April and May will bring forth in time for her litter to be weaned and become strong growing pigs before cold weather comes on; after which they may be fattened for pork. The young pigs littered in February and March will be strong for herding over the stubbles in September, and large enough for feeding into good bacon hogs during winter. The boars should be castrated when six or eight weeks old, and the pigs weaned shortly afterwards. Swine may be fed on mangold wurzels and cut clover in yards during summer; the waste of the dairy should be given to the young pigs, with wash and brewers' grains and steamed food.

Poultry.—We quote from *The Poultry Yard*, in a diary by an Essex amateur,* for April and May:—

"In April and May, hatch as many chickens as you wish to have. The old fowls, now laying abundantly, must not only be well fed, but should have a good change of food. Give early hatched broods plenty of plain, wholesome food, pure water, clean untainted roosting places, and a good run. Very early broods are chiefly beneficial in

* Ridgway, Piccadilly.

fowls of large size. While setting the hens, take care to avoid the necessity for future over-crowding. Look after such young chickens as are hatched, feed them with crumbs of bread soaked in milk and squeezed dry ; but for twelve hours or so after having broken the shell they require nothing : if very weakly, give a little bread steeped in beer, and squeezed dry as before. Set turkeys over from eleven to fifteen eggs ; marshy ground is better for very young goslings than open ponds. Young goslings still require soft feeding. Young ducks may now be admitted freely to water when the weather is fine. Give extra care to chickens when first beaten off by the mother, and a warm, sheltered run to unfledged motherless broods ; decrease the number of old fowls ; remove deep waterpans ; and get rid of vermin if you can. Keep young turkeys from damp. The first clutch of ducks should be fit in May for table use. When chickens are established out of doors, the next thing is how to feed them. Crushed barley for dry food, and barley-meal with a little bran mixed dry and crumbly, are the standard dishes for the chickens. Give each brood daily an egg boiled hard, chopped fine, and mixed with crumbled bread and the shell broken up quite fine. Young chickens have the requirements of old fowls ; they must have small stones and lime, the last is especially necessary for making the as yet unformed bones, and may be given in the form of pounded oyster-shell, old mortar, chalk and egg-shell broken up small. In addition to crushed barley and meal food, a change is good ; but avoid pampering their appetites, which would make them dainty instead of promoting growth by encouraging healthy feeding."

JUNE.

The ordinary weather of June may be ascertained from the weather table on next page, compiled by Mr. Lowe, of Nottinghamshire, in which the temperature and rainfall for a number of years at different stations in England are specified.

The ordinary farm operations of the month of June include those (1) of the *fallow field*, where (2) *the application of lime* to the soil is often at this season effected ; (3) *haymaking* ; (4) *turnip culture* ; (5) *the summer cultivation* of other crops ; (6) *the management of the live stock* of the farm.

THE WEATHER OF JUNE.

LOCALITY.	AUTHORITY.	Mean temperature.		Lowest mean temperature.	Highest mean temperature.	Greatest heat.	Lowest maximum heat.	Highest minimum cold.	Greatest cold.	Average amount of rain.		Greatest amount of rain.	Average number of rainy days.		No. of years' observations.
		°	°	°	°					inches.	inches.		days.	days.	
Guernsey.....	Dr. Hoskins, F.R.S.	56.6	52.6	60.1	80.0	66.0	52.0	44.0	2.3	0.6	5.0	10	3	21	12
Helston	Mr. M. P. Moyle ...	60.9	57.7	65.3	88.0	71.0	49.0	37.0	2.5	0.3	5.1	11	4	23	16
Exeter	Mr. W. H. Ellis.....	58.3	54.3	62.0	87.8	69.2	47.2	39.4	2.6	0.8	6.9	15	9	28	7
Ventnor, I. of Wight	Dr. Martin	59.5	55.2	67.0	86.0	63.0	53.0	42.0	1.8	0.4	4.8	11	4	22	22
Worthing, Sussex	Dr. Barker	57.5	54.5	62.5	76.6	68.0	51.8	40.5	2.2	0.6	5.0	11	4	21	8
Clifton, near Bristol	Mr. W. Burder, FRAS	56.9	53.0	61.5	86.2	68.4	45.6	38.3	3.2	1.7	7.1	15	9	28	8
London Royal Observatory	{ The Astronomer Royal, F.R.S. }	58.0	51.0	65.3	94.5	72.7	52.7	36.2	2.1	0.2	5.8	12	5	23	90
Bedford	Dr. Barker, F.R.A.S.	58.8	54.9	66.3	97.0	71.5	50.0	38.5	2.4	0.6	4.3	14	7	27	10
Lampeter, near Cardigan	Rev. Prof. Mathews, M.A. ...	56.2	52.3	59.8	91.0	72.6	39.6	33.0	3.6	1.8	7.5	17	12	29	6
Norwich	Mr. W. Brooke, FRAS	57.6	54.0	64.4	90.0	71.0	44.0	38.0	2.1	0.4	4.5	9	3	20	12
Highfield-House Observatory ..	Mr. E. J. Lowe, F.R.A.S.	58.7	53.8	67.7	92.2	73.5	48.0	35.1	2.8	1.0	5.0	13	8	25	51*
Oxford Observatory	Rev. R. Main, F.R.S.	58.1	53.9	63.0	90.0	69.0	46.5	37.1	2.7	1.0	6.6	13	4	26	34
Grantham	Mr. J. Jeans, F.R.A.S.	56.7	55.1	57.9	83.0	71.6	43.4	38.0	2.3	0.7	3.8	14	6	24	10
Hawarden, Chester	Dr. Moffat, F.R.A.S.	55.8	51.7	60.0	82.0	67.0	45.5	40.0	2.9	1.6	4.4	14	8	27	10
Manchester	Mr. G. Vernon FRAS	58.4	55.2	63.3	91.2	71.4	47.0	38.0	3.3	1.4	6.0	16	8	25	11
Leeds	Mr. H. Denny	58.5	54.0	63.0	99.0	70.0	44.0	37.0	2.7	1.6	4.4	15	7	26	10
York	Mr. Ford	57.3	53.8	61.3	86.0	68.0	44.0	32.0	2.5	0.9	7.3	13	6	22	20
Scarborough	Mr. B. Cooke	53.3	50.9	55.8	79.1	68.0	46.1	40.0	1.7	1.1	2.1	8	5	10	6
Isle of Man.....	Mr. J. Burman, FRAS	53.9	51.5	57.0	82.2	67.5	43.0	39.0	2.4	1.7	5.0	14	8	23	7
Durham Observtry	Mr. A. Marsh, FRAS	55.3	52.3	63.5	83.3	68.5	43.1	33.1	2.5	0.6	4.4	13	4	28	12
North Shields.....	Mr. R. Spencer	55.7	52.1	58.7	80.3	65.0	48.8	37.2	3.3	1.0	7.5	17	11	27	16
Silloth	Rev. F. Redford, FRAS	57.2	53.8	60.8	81.8	70.4	41.0	35.5	2.4	1.6	3.8	13	6	22	3

* Observations at Highfield House on temperature extend over fifty years, and at the Royal Observatory over ninety years.

I.—FALLOW OPERATIONS.

These are now generally made consistent with the cultivation of a crop. A bare fallow is either the result of exceptional circumstances, as of a very wet season; or it is practised only on stiff and still undrained clay soils—the profitable cultivation of which for turnips or mangold wurzels may be still impossible.

After the conclusion of spring work, and especially after the work of turnip culture is for the most part over, as towards the end of June or during July, attention can be given to such fields as are to receive a bare fallow previous to a crop of wheat. The process consists in repeated ploughings, harrowings, grubbing, and cultivatings, harrowings, rollings, harrowings, and weed gatherings; until, as its result, the land is friable and clean and dry, when it is left until the wheat seedtime. Towards the end of the season, and before the last ploughing, lime is often applied, and a dressing of farm-yard manure is given; both being ploughed under with a shallow furrow, and the soil is then left to consolidate before the seed is sown.

The land can, however, in most cases, be brought into the proper state at the proper time, and yet have borne a valuable crop of turnips and of mangold wurzel, which being fed upon the farm produce a great store of manure and a good yield of beef and mutton—enough to well repay expenses; while at the same time the soil is benefited by a thorough tillage during their growth, and by bringing upwards from the subsoil a great store of useful matters, extracted thence by roots and deposited during growth in the crop above ground, whence it is returned, by the manure derived from its consumption, to the surface soil, which is thus enriched.

Both in the preparation of the land for fallow crops and the tillage of the land during a bare fallow, certain implements are employed, to which I will now refer.

1. **The Plough.**—It seems to be generally admitted that, in order to the thorough tillage of the soil, a definite layer of earth must once now and then be clean cut off from the body of the subsoil on which it rests, and turned and stirred, and, as it were, combed clean. Stirring of the soil, if wholly depended on, seems to fail of that perfect detachment of the soil from its lower bed which is necessary to a perfect fallow; and thus, even where the grubber is becoming more and more the main implement of tillage, yet a ploughing before winter is generally admitted to be necessary. There is, as everybody knows, a great rivalry in the manufacture of this implement; but, excepting the great distinction of wheeled and swing ploughs, the difference amongst our best implements is but very slight; the difference of draught is not great, and the difference of cost is inconsiderable. Nevertheless, ploughing-matches are everywhere still

held, in which the object is not only to determine the merit of the ploughman—which is generally ascertained with ease—but that of the implement he holds, which by such a trial cannot be determined. Besides the difference of the presence or absence of the wheel, there are differences in the structure of the framework and in the length and fulness of the mouldboard, which are represented in the following figures:—

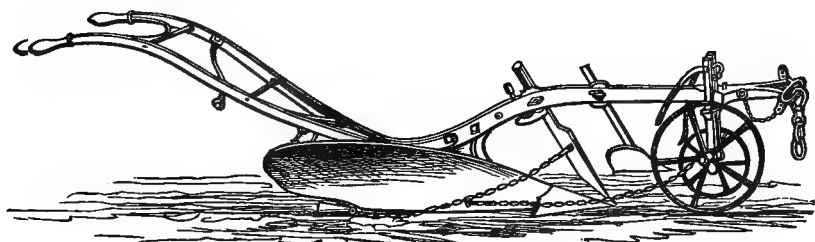


Fig. 35.—Ransome's Y. W. B. Plough.

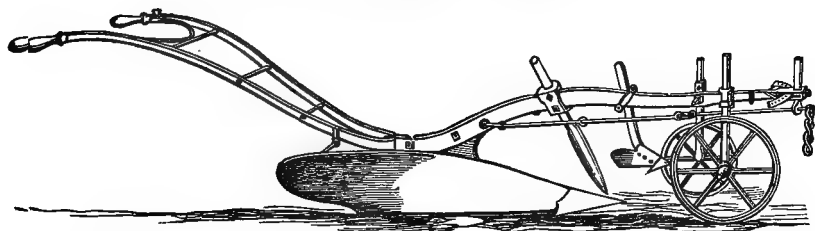


Fig. 36.—Howard's H. H. Plough.

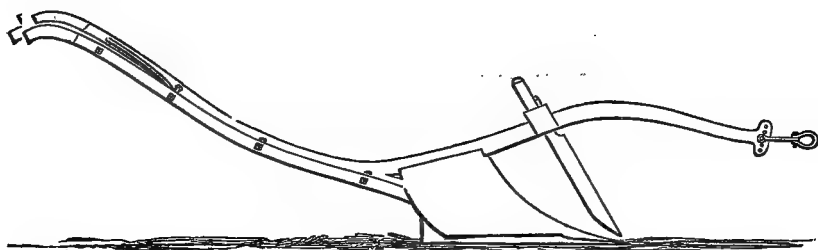


Fig. 37.—Mid-Lothian Swing Plough.*

The first two drawings have been taken with care from implements in the wareroom of the Agricultural Engineers' Company, Swan-lane, E.C., to which access was kindly given to me by Mr. O'Doherty, the manager; the third is reduced from an elevation in Mr. Stephens' "*Book of the Farm*," where a full detail and analysis of

* This figure, as well as figures 40 and 41, are reduced from the plates given in Stephens' "*Book of the Farm*."

its construction will be found. The greater abruptness of the Scottish mouldboard, and greater simplicity of construction throughout, are represented in the above figure. The exact nature of the curve which the mouldboards severally exhibit is seen in the following figures representing the plan of each as seen from above.

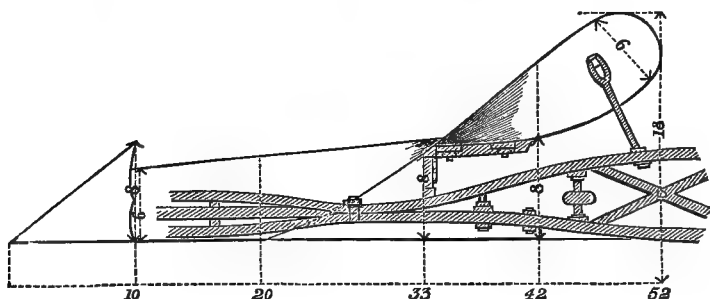


Fig. 38.—Plan of Ransome's Y. W. B. Plough.

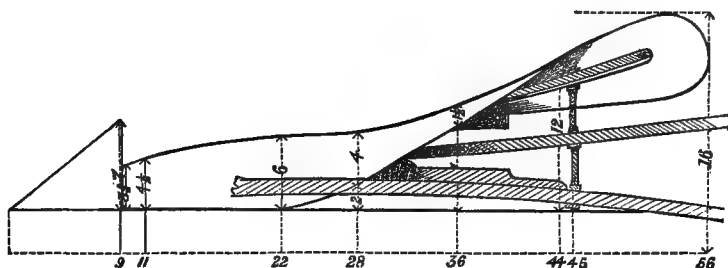


Fig. 39.—Plan of Hornsby's H. H. Plough.

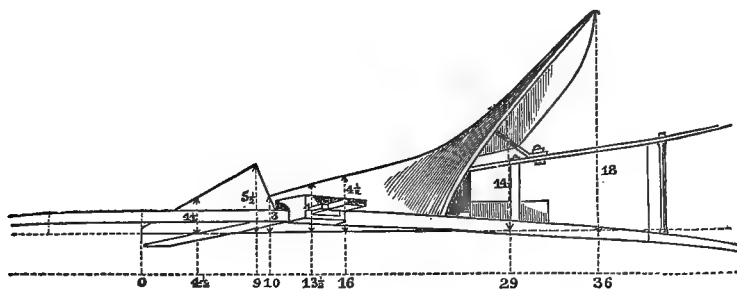


Fig. 40.—Plan of Wilkie's Plough.

These are drawn to one scale, and show—1. The trussed structure of beam adopted by Messrs. Ransome; 2. the flat breast adopted by those makers in their mouldboard, and by the makers of the Mid-Lothian plough (Fig. 41); 3. the full breast adopted by Hornsby and by Wilkie in the structure of their mouldboard. Howard's mouldboard is midway between these. The flat mouldboard is that which appears to us most likely to accomplish its work easily.

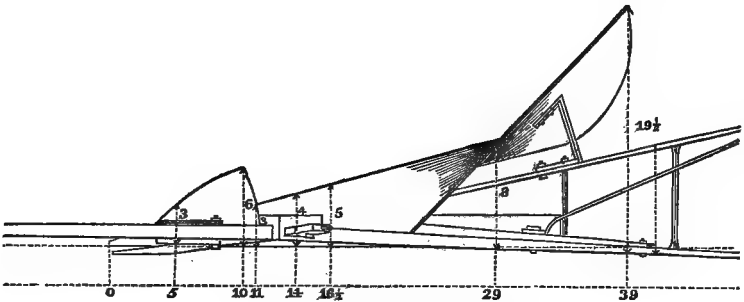


Fig. 41.—Plan of Mid-Lothian Plough.

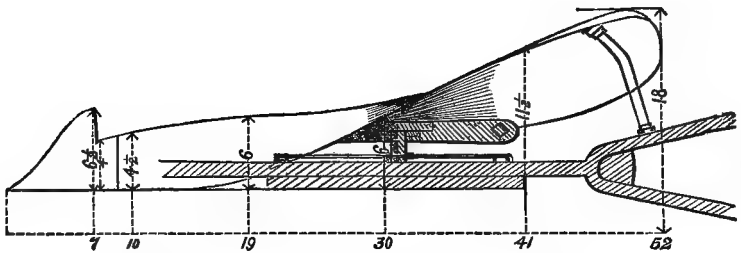


Fig. 42.—Plan of Howard's H. H. Plough.

The rounded full breast pushes the furrow-slice home, especially along the middle of its breadth, and thus squeezes the lip or upper edge of the slice into a peaked ridge, which gives a better defined appearance to the work, but is otherwise of little value. This peaked form is given in the Scottish plough, by the slice being cut of an acute angle, which is accomplished by the coulter being set, as will be seen in Figs. 40 and 41, so as to undercut the fast unmoved land, and by the sock or share being set, so that it is not a perfectly horizontal floor which it leaves behind it, but one inclining downwards from the moved land. Neither of these things are worthy of imitation, and the English ploughs which cut a horizontal floor and a perfectly rectangular furrow-slice are to be preferred. As to the use of the wheel, the question used formerly to be a first-class

agricultural controversy, and the charge of prejudice on one side and on the other was probably true of both, until the experiments of Mr. Handley and of Mr. Pusey had shown that the universal preference in Scotland, and the occasional preference in England, could only "here and there" be justified; and that, as a general rule, the addition of the wheel enabled better work at a less expense of draught. What has been the subsequent history of this question? It has at length been taken almost entirely out of the region of dispute, and a single fact may be regarded as conclusive of it. Probably no ploughmakers of the present day have a larger or more widely-scattered body of customers than the Messrs. Howard, of Bedford. They inform me that during the last six years 30,000 ploughs have left their works, and of these "not more than 25 out of every 1000 have been swing ploughs!" Other first-class makers, both of a longer and more recent reputation, Messrs. Ransome and Messrs. Hornsby, would, I believe, relate a similar experience. Of course, the almost unanimous voice of those who purchase ploughs must at length be taken as a better test of quality and value than any single or repeated ploughing-match, however carefully superintended, can be; and I believe the leading manufacturers of the plough, reflecting the experience of their customers, will now give an almost unanimous verdict in favour of the wheel.*

I may add here a reference to an implement half way between the plough and the cultivator, invented by Mr. Hancock, of Gloucester, which is certainly a very efficient tool for tillage purposes. It consists, as is seen from the drawing, of a framework carrying three mould-boards at different elevations, for any of which, however, cutting knives may be substituted. And the earth which it moves is thus stirred, and mixed, and broken at one operation.

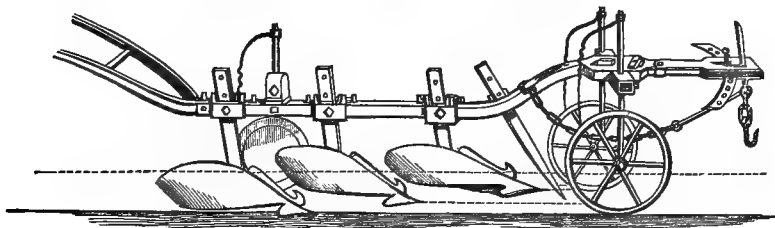


Fig. 43.—Hancock's Pulverizing Plough.

2. The Harrow is required not merely to break the surface clods of rough ploughed land, nor only to gather weeds out of it; a great

* From my paper on recent Agricultural Experience, in the 9th Vol. of the "Bath and West of England Agricultural Society's Journal."

part of its value depends on its power of also loosening the surface of the soil, and thus allowing the air access to the roots of the plants growing on it, and to the manure lying in it. This is evidently the case from the advantage, frequently most marked, that attends the use of this implement, in spring, over young wheat or corn of any kind. A harrowing in such a case, which would appear most likely to destroy the young plants, is found to cause them to sprout and shoot out with increased vigour. This is especially the case on those soils which are termed *sleepy*, from their tendency to run together after rain, and thus to form a surface almost impervious to air. The harrow is used for three purposes,—first, to break the surface-clods, and reduce the surface of ploughed land; secondly, to gather together and shake out the weeds that are in the soil; thirdly, to cover the seed.

For the last purpose a lighter implement is used than for the former, and the teeth are nearer together.

The best form of the harrow is the rhomboidal, with the teeth at equal distance throughout. A pair, when hinged together, gives sufficient work for a pair of horses. It is this form alone which ensures that all the teeth shall work in different paths, and that thus the whole of the ground shall be uniformly stirred and broken.

In many districts the harrow is used not merely to reduce the surface of ploughed land by tearing down the lip of the furrow slice, but to stir and lift the furrow-slice to its whole depth. This is not the proper office of the harrow; it should be done by the grubber. The use of heavy drags for this purpose, and the application of great power to work them (I have frequently seen teams of six and eight oxen drawing a single heavy harrow or drag), cannot be economical; it would be much cheaper to use an implement for the purpose manageable by two horses. The grubber, or cultivator, presently to be described, is such an implement.

Though, however, the harrow should not be employed to stir the whole depth of the furrow, it should stir it *perfectly* to the depth to which it goes, and for this purpose it is well to give the teeth a slight inclination forwards, that they may have a sufficient hold of the ground.

Good harrows, as now made, are essentially rhomboidal in their form; and Howard and Page, of Bedford, and Bentall, of Maldon, are among the most noted makers of them. An ingenious modification of the harrow has recently been introduced, in which a toothed surface is made to rotate as it is drawn across the field. This is effected by so loading it as that one side digs rather more into the soil than the other, and thus presents greater resistance to the onward motion of the tool. The drawings below show how this is effected. In Crosskill's harrow, Fig. 44, two such circular frames as are there drawn are connected, and at the same time thrust

asunder at top by the bar shown in the drawing; the central pin is thus forced outwards, and the further side of each circular frame is pushed downwards. A very slight depression is enough to give the rotatory motion that is desired.

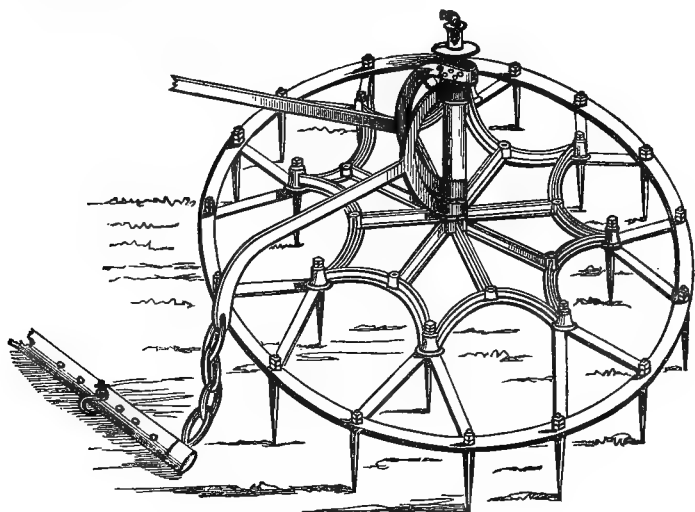


Fig. 44. —Crosskill's Harrow.

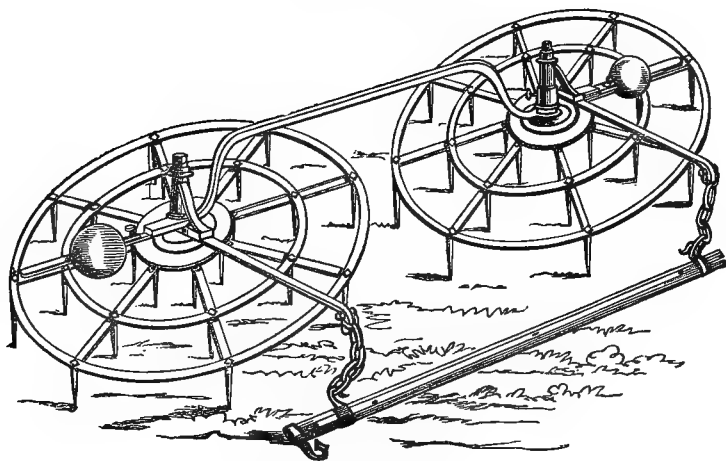


Fig. 45. —Ashby's Harrow.

In Ashby's form of the tool, represented in both its parts in Fig. 45, the same effect is produced by the weight shown in the drawing,

which may be placed further from the centre or nearer to it, as is desired, and so the requisite rotatory motion is given. The result of a combination of the circular with the onward motion is seen in the more thorough disturbance of the whole surface of the land over which the tool is drawn, and this is the object aimed at by the harrow.

3. The Cultivator.—The value of the cultivator or grubber as a tillage implement was gradually realized during the early years of the English Agricultural Society's career. Biddell's scarifier was described in the first volume of their Journal. The Uley cultivator soon afterwards attained distinction at their annual exhibitions. "Cat's-claw" and other "drags" in their turn achieved a reputation; and Bentall's "broadshare" and Coleman's scarifier are now probably in the foremost rank. Finlayson's grubber, and modifications of it, adapted to pair-horse cultivation, preceded all these; but this is nearly the subsequent history of the implement. There is not, among the lessons of recent agricultural experience, one of more general utility, hardly one of greater importance, than the serviceableness of the cultivator as a tillage implement. Though, however, it is admirably illustrated on thousands of farms, and well represented in the annual show-yards of our leading Societies, it has hitherto received no adequate illustration in the pages of their Journals and Transactions. It is to be attributed to the extension of land-drainage, that an implement which stirs the soil is gaining ground over one which turns it over. Stirring implements cannot be used when land is wet. The soil may be turned with impunity, and even with advantage, when stirring it would only knead and injure it. But on all drained clay soils it is becoming more and more the practice to plough only before winter, and to depend on the cultivator and harrow for obtaining tilth in spring. This prevailing practice is, of course, leading to an increased manufacture of this class of implements. If we had before us the accounts of all the agricultural implement-makers of the country for the past few years, they would most likely tell us that in nothing has there been a more marked agricultural progress than in the extended use of the cultivator, scarifier, and grubber, as a substitute partly for the plough, and partly for the heavy drag-harrow.

In order to ascertain the increased use of different classes of agricultural machines, in illustration of the lessons of recent agricultural experience, I lately made inquiries on this and other points of most of our implement-makers. Unfortunately, many (one of the leading makers of cultivators and broadshares among them) did not think with me, that the figures obtained in this way would be trustworthy illustrations of my subject; and as it is only from some of them that I have obtained returns, their figures may really show not only the tendency of general agricultural experience, which is

what I wish to exhibit, but also the waxing or the waning reputation of the individual manufacturer, with which in these pages I have nothing to do. It is nevertheless interesting, in connexion with this subject, to know that a single leading manufacturer has sent out many thousands of cultivators during the past five years, and is now executing orders at the rate of several dozens weekly; and taking the experience of a less well-known manufacturer to represent the increase of a merely local demand, it is interesting to learn from a maker who has only lately begun their manufacture, that during the past four years he has sent out 25, 36, 87, and 183, respectively, of his patent cultivator.

The use of the cultivator with the occasional employment of the plough, instead of the use of the plough with the occasional employment of the cultivator, is now, and as a lesson of recent agricultural experience, generally admitted to be the most economical way to the attainment of tilth. On clay land especially, as already said, a single ploughing before winter is almost all that such land should receive throughout the year. Spring work should, if possible, be confined to the use of implements which stir the furrow-slice, and the seed-bed should be prepared upon the winter-weathered surface. No other surface, turned up by a spring-ploughing, can be generally reduced so easily or perfectly by the roller and the harrow.

Describing his spring management of the land intended for root-crops, Mr. Sainsbury, of West Lavington, Devizes, tells me:—

“In the month of March the scarifier (or cultivator) is used across the fallows in preference to the plough, and I use the harrows occasionally, to destroy any annual weeds that may vegetate. I have proved, from experience, the scarifier should be used on the same day as the seed is to be put into the soil. I have a great objection to the plough crossing the fallows, as I have frequently seen the land afterwards work unkindly, and when the season comes for drilling the seed, the ground wants moisture for it to germinate. By using the cultivator you have a better tilth and a firmer seed-bed, which is beneficial for all root-crops.”

Mr. Sainsbury adds, in corroboration of the practice recommended: “I may almost say I have not lost a piece of roots on my farm in the course of twenty years.” This is where turnips are drilled on the flat. The following testimony on the same subject, describing the experience of Mr. Hepburn, of Aconbury Court, by Ross, Herefordshire, relates to root-crop cultivation on the ridge. The statement was not written in reply to any question as to the cultivator, but as it describes and defines the proper use of that implement in the course of green-crop cultivation, it may be given here. Mr. Hepburn says:—

“With respect to the modes of cultivating root-crops adapted to the difficulties of the past season (1860), the following remarks are

limited to clayey loams that have been drained, and where the farmer will take special care that nothing shall be done when the field is obviously unfit for working, or that it shall be abandoned after a short trial has proved its unfitness, and immediately after it has been injured by a passing storm of rain. It is also necessary that he should be convinced by experiment that it is advisable to drill on ridges not less than 27 inches apart, to hand-hoe at least twice, and to horse-hoe, not merely to kill weeds, but to stir the ground, as often as the other labour will permit, until the leaves have met in the rows. Soils of this class suffer least injury from rain when lying in the plough-furrow, next in the tine-path of the grubber or cultivator. The roller may be judiciously used in the *same direction* after either of these implements, with comparative impunity, but it is a golden rule *never to leave them harrowed down*; the plough or cultivator should follow in close succession to the harrow until the ridglets are formed.

"Presuming that the field has had a deep furrow in winter or early spring, and that it is in fine working condition in March or April, the cheapest and most expeditious method of preparing for sowing is to give a deep stirring with the cultivator across the plough-furrow; the next stirring should be across the former, either in immediate succession, or, what is much better, after an interval of several days or even weeks. When the roller is used, it should be in the same direction as the previous stirring, so that the tine-paths may not be obliterated. After the harrows the cultivator should closely follow, for reasons that have been already stated.

"It is quite possible to procure a pretty decent tilth for ridging during unsettled weather, when the land is too wet for using the cultivator, by the judicious use of the plough alone. After ploughing lengthwise, as soon as possible plough across; a light roller may be used immediately before the ridging-plough, or, if the weather is very ticklish and the land treacherous, in the morning's yoking plough as much of the land at an angle as the same number of teams can plough lengthwise, and drill up in the afternoon. Forethought and energy judiciously applied will command success under very trying circumstances.

"A fine tilth is desirable for root-crops; but on such soils, and especially in such seasons as that of 1860, it may cost too much. Many small clods, and even a few large ones, are no insuperable obstacle to ridging, neither are a few root-weeds, although their presence is always to be regretted. In addition to liberal manuring, sow one-half more than, or even double, the ordinary quantity of seed per acre: this will secure a thick braird and *ample pasturage for all insect-foes*: but the bunching or singling, and the extra horse and hand hoeings required by the probably foul state of the field, will all enhance the cost of cultivation.

"It is to be hoped that we shall be exempt from such a season as the last for many years to come; but a small experiment, conducted on these principles for two or three successive years of average character as respects weather, will enable any farmer to judge how far they are applicable to his own peculiar circumstances."

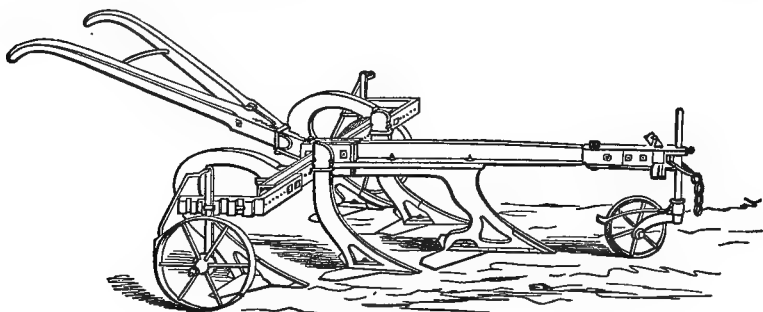


Fig. 46.—Bentall's Grubber.

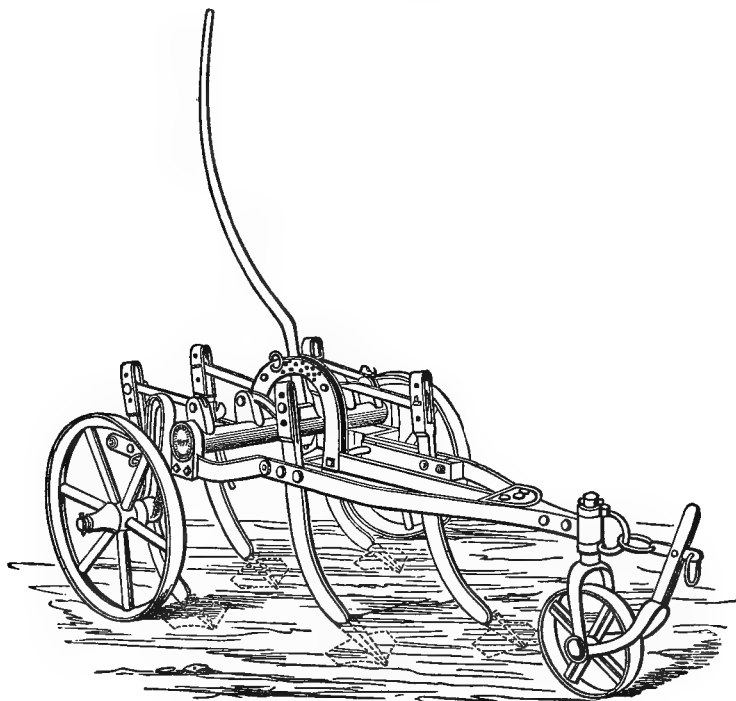


Fig. 47.—Coleman and Son's Patent Cultivator.

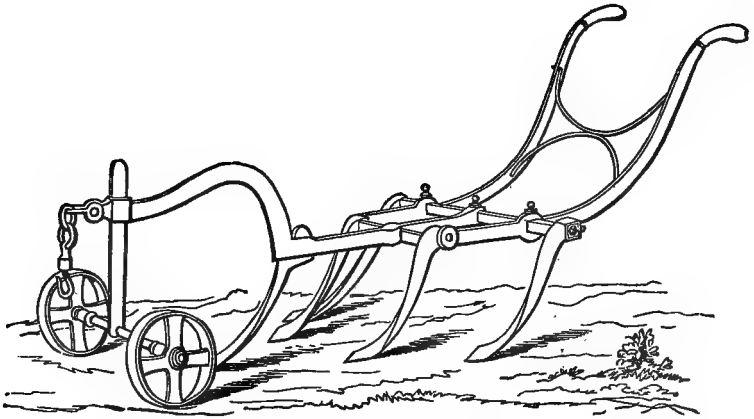


Fig. 48.—Tennant's Grubber.

In a subsequent letter on root-cultivation Mr. Hepburn says:—

“The grubber or cultivator is too little used for this purpose. I speak from experience, and have seen enterprising farmers, above 75 and even 80 years of age, in Scotland, cast prejudice on this subject to the wind. After laughing at younger men for two or three years, it was impossible to resist the results of a skilful handling of the grubber after one deep winter furrow.”

It must suffice to point out, as a last witness to the value of the cultivator as a tillage implement, the increasing use which it is obtaining in steam cultivation. Mr. Smith, of Woolston, has indeed all along used the grubber as especially the tool for his purpose; and Mr. Fowler, with those who use his apparatus, places his steam cultivator at least as high in point of merit and efficiency as his steam plough.*

We have given above drawings of three of the principal cultivators now in use. Bentall's and Coleman's grubbers generally divide between them the prizes of the English Agricultural Society; and Tennant's is a very simple and efficient tool, and much used in Scotland.

4. The Roller.—Besides the plough, harrow, and cultivator, rollers must be named, as, like the other tillage implements, of use in fallow operations. The roller is employed for levelling the surface for scythe or reaping machine, for crushing clods, for keeping in moisture, and for consolidating the land about the roots of plants.

The common roller is a mere cylinder of wood, or stone, or iron, and is drawn over the land by means of a framework made as light

* The above remarks are from a recent paper, already quoted (see p. 296), in the *Bath and West of England Agricultural Journal*.

as is consistent with the requisite strength. In turning, of course it rubs over the ground and destroys the surface, unless a very large course be taken in turning, and when rolling your wheat, for instance, in spring, some damage is suffered in this way. This is partly remedied by dividing the roller into two or more sections, which if the machine be turned round shortly, will of course revolve in opposite ways instead of tearing up the surface of the ground.

This division of the roller into parts has reached the length of converting it into a number of separate discs, strung upon a common axle, having independent motion on the same. Mr. Crosskill, of Beverley, in Yorkshire, brought out several years ago a clod crusher on this principle. His patent right has now expired, and English agricultural machine-makers have applied it during the last few years in bringing out an endless variety of clod crushers. They are nearly all alike in that they consist of a number of independent discs, varying only in the form of their edge. There is, however, this additional difference observable—that some of them have alternate discs of a somewhat smaller size, being furnished of course in this case, with a larger slot, through which the axle passes, in order that the disc in question may not be merely uselessly slung upon the axle, but rest like the others on the ground. The purpose served by these loose smaller discs is to give greater variety of motion to the parts of which the machine consists, and so enable it to fill hollows in the land, and hinder it, too, from becoming clogged with earth. The cost of the single modern roller need not be more than 3*l.* or 4*l.* The cost of the clod crusher made of iron discs varies with its width and other circumstances from 12*l.* to 18*l.* Mr. Gibson, of Newcastle-on-Tyne, makes a roller, or presser, consisting of two parallel rows of blunt-edged circular discs, revolving on axles parallel to each other, those on the one revolving partly in the intervals between those on the other; and this, I believe, proves a very efficient machine. Another form of presser—one which has been long in use, and is likely long to remain so on light land in some English districts—is the so-called drill-presser, which is just a pair of wheels, so to speak—the one side of the axle having a common cart-wheel on it, and the other a couple of heavy wheels shod with a rim of a triangular section. The object is, that this shall press the seam in the furrows as the land is ploughed; and accordingly in using it a single horse draws it along behind two ploughs following one another—the horse walks in the wake of the last plough, and presses the third and fourth furrows from the last which has been turned, so that no displacement of the plough work is produced—only a consolidation and deepening of the ribs—into which the seed sown broadcast falls, and finds a firmer bed than the soil would naturally afford—and it comes up as if it had been drilled:

This drill presser sometimes takes the form of a number of angle-shod discs, and is drawn over the field after the ploughing is completed, the distance between the discs being just the width of the furrow-slice. And in dry spring weather over land ploughed out of lea for oats it produces a very desirable result in the pressure which it brings to bear on the seam between the furrow-slices as the seed-bed of the future crop.

It is also right to name a roller known as Cambridge's, in which the discs upon a common axle are strung close to one another, and each having a ridge-like rim, the whole results in a corduroy-like pressure of the surface. It is a capital tool, much used in the south of England, especially for rolling corn in spring; as after sowing clover and grass seeds, for instance, over the barley crop.

II.—THE APPLICATION OF LIME.

The effects of drainage upon land are after all due to the improvement thus effected on the soil considered more as the vehicle of nourishment than as the warehouse in which it is stored. Those practices which directly add what plants need to the land, or which alter there things now useless or injurious, converting them into food capable of contributing to the growth of plants, are at least of equal importance.

Lime is one of the most important of many fertilizing applications made to the land with these purposes in view. There are few farms in the country to which it has not been applied, and on most it is periodically applied at greater intervals of time or less. On many farms it is added once in every lease of perhaps twenty years' duration—a heavy dressing, often as much as two bushels or more to every perch—320 bushels per imperial acre: while in other districts it is common to put it on at the rate of half a bushel, or perhaps even less per perch, applying it once in every rotation of crops.

I believe the heavy dressing is the plan usually adopted in Scotland; it is the plan which certainly ought to be adopted in all cases where land is put under altogether altered management, as when it is broken for the first time out of waste or grass. The more frequent liming in smaller doses is the practice commonest in England. And there are some districts where it is not applied at all, and where experience has proved the application useless. Thus, at a recent agricultural meeting at Chester, an appeal by a farmer of the county to his brother farmers present was met by a universal assent to his assertion that lime on their pasture was of no avail. What the explanation of this may be I do not know; that it arises from exceptional circumstances there can be no doubt, considering

the great body of testimony to the value of the application on grass lands and on arable in almost every other district of the country.

The universal testimony is that it renders stiff clays more friable and more easily worked,—that it facilitates the cleaning of light soils, being directly prejudicial to the growth of certain weeds—that it makes peaty soils firmer, and quickens the decomposition of vegetable fibre within the soil—that it makes all soils more productive. Crops after liming are not only more productive, they are sounder and more healthy.

It improves the produce and the quality of grass lands—it renders the turnip crop bulkier and freer from disease,—it gives more abundant crops of wheat and barley. Barley especially comes at first a bulkier crop, and afterwards a better one, after the application of lime. Beans and peas and vetches, which contain a good deal of lime in their structure, are also especially benefited by its application. Peas acquire in this way boiling properties. Potatoes on clay lands and on peaty soils are certainly benefited by lime.

Let me illustrate these several assertions by instances. Sir Charles Monteith gives in the second volume of the *English Agricultural Journal*, the following report of his experience on peaty soil in Dumfriesshire:—

“When the first crop grown upon it was potatoes, well dunged, but without lime, the potatoes were found to be hollow in the heart of them, and very watery; while in other parts of the meadow upon which dung was employed, potatoes of a good quality were produced when lime was employed in addition to the dung.”

Take the following instance from the report to the Board of Agriculture on Northumberland farming (*Agricultural Journal*, vol. ii. p. 180). Mr. Bailey, the reporter, says, “When looking over Mr. Hunt’s farm, at Thorington, we came suddenly upon an alteration in the verdure of the grass. One side was eaten very bare, and covered with a thick mat of clover and rye-grass; the other was a dingy moor, chiefly composed of small bent and sheep fescue, and in a great measure neglected by stock. An explanation was required for so great a contrast, and the tenant told us that when that field was last in fallow the parts eaten so bare and looking so green was well limed; but the other, which was left uneaten, had never been limed.”

These are both instances from olden times. Take the following case within my own experience. When the grass fields of — Farm were broken up, a heavy dressing of lime—two bushels to the perch or rod—was laid upon the first corn stubble after drainage. On one of the fields a couple of ridges were left unlined. The ploughing of that field was ultimately altered, so that the position of those ridges lay afterwards across the lands as the field was ultimately laid up; and for many years afterwards—continuously indeed until the

defect was remedied by the application of lime to the place—the site of the ridges was marked at harvest time in every successive corn harvest—wheat, barley, or oats—by a dwindled, stunted growth, and ill-formed ears.—I will give another illustration. Joseph Gilray, a Devonshire farmer, writes thus to the editor of the *English Agricultural Journal*, the late Mr. Pusey:—"The ordinary application used by me is eight to ten tons per acre. On one occasion I had put ten tons per acre on four acres of a five-acre field (and on the remaining acre a considerably larger quantity was applied by accident), the wheat crop on that acre was three bushels an acre the better for that heavier dressing; the grass and clover seeds which followed it were the better for it; and to this day," he adds, "six years afterwards—for this close has been pastured ever since—the difference may be seen between the one and the four acres." This was a strong, clayey land. As to heathy, moory land brought into cultivation, the effects of lime have been declared by every one who has applied it; and it is universally almost the first application that the land receives. Mr. Watson, land agent, of Kendal, says, vol. vi. *Ag. Journ.* p. 93—

"I have a plot of ground in this neighbourhood, 166 acres in extent, which formerly grew little except heath. A good dressing of lime was applied over the top sward, which has more than doubled its value. This was done," he says, "fifteen years ago, and it has totally eradicated the heaths. The lime to this day appears in full action, as its effects annually testify from the richness and sweetness of the herbage, the quality of which has been wholly changed. The deep green hue and luxuriant appearance of this land in spring and autumn form a striking contrast with that adjoining, which is still unimproved. The soil was in this case a thin, moorish loam, in a high climate, resting on the greywacke formation." He gives another instance. "A farmer," he says, "well known to me, who had a large plot of unreclaimed heath land, and who had only three years of the lease to run, having received notice to quit at the end of his term, thought he would break up this piece by paring and burning. Lime, however, must be dispensed with, as he calculated that in two crops he could not possibly be repaid for such an outlay. It so happened that on this large plot there were a few patches of impoverished land, from which nearly the whole of the vegetable turf had been cut and carried away by a former tenant. These parts were considered so much reduced that it would be impossible to raise a crop upon them without a small quantity of lime in addition to the sprinkling of ashes, which was therefore applied as an act of necessity. The consequence was, that these very inferior patches produced double the quantity of grain and straw to every other portion of the field when in crop, and in after years the herbage was much more luxuriant and of a finer texture. I am satisfied that if in this case 150 or 200 bushels of lime had been applied, the cost of which in-

cluding cartage would not have exceeded as many groats, an adequate return at least would have been the result in the first crop."

On the soundness of the turnip crop, as at any rate contributed to by the application of lime, I will give the following instance:—Mr. Hunter, of Haugh, West Lothian, describes in the Number of the *H. Soc. Transactions* for July, 1856, his experience in a field of Swedish turnips, which had previously been subdivided by a wide fence, now removed. Unhealthy spots (he says) began in the month of August to be observable up and down the field, and they gradually extended until there was not a sound root north of the old fence. Fortunately, in the small portion south of the old fence no disease existed. Lime had been applied to that part ten years before; while the northern part had probably never been limed, certainly, at any rate, not during Mr. Hunter's occupancy; so this fact was a guide to his future proceedings with reference to the finger and toe disease. Lime was applied in various forms and at various periods in the rotation. It failed in several of the cases tried; but when put on over the grass previous to its being ploughed up for oats, the subsequent turnip crop was successful, the exception being a striking testimony to this as the explanation of the rule; for on certain patches where hayricks had stood at the time the lime was applied the crop had failed, proving that the absence of the lime was as complete a surety for the failure of the crop as its presence was a surety of success.

I will give one more illustration of the influence of liming on the general value of the land. Mr. Blake's improvements on Brendon Hill, in Somersetshire, are thus described by Mr. Acland (*Agricultural Journal*, xi. p. 409):—"After draining this land, which is in as sour, bleak, and backward a country as can be instanced, Mr. Blake laid on 100 bushels of lime per acre, and laid it down to permanent grass, giving it afterwards fifty bushels per acre of lime every three years, and letting it by auction as summer pasture to low country graziers. The increased value is as follows:—Venne Farm consists of 235 acres, and was valued in 1832 at 115*l.* per annum. 166 acres of it were let annually, after the improved management, at 365*l.* Cookesley Farm consists of 129 acres, valued in 1832 at 45*l.* a year, and of these 95 acres were let in 1849 at 176*l.*

The illustrations I have given prove what I might indeed have safely left as a simple assertion which agricultural experience universally corroborates, viz., the fertilizing influence of liming land. And now let me add here a word or two to those readers who may hereafter superintend the management of landed property in the interests of the owner.

Liming acts like burning and some other occasional agricultural operations, by bringing into immediate use the dormant powers of the soil. That account of its influence on the barley crop which I have given, viz., first making it bulkier and ultimately better, is an

illustration of its effect. Its influence as direct food for plants is a comparatively very small part of its whole effect; it is because it acts as a key to a locked warehouse, full of food, but useless till the door is opened, that it is especially influential. Like burning, therefore, it is liable to abuse—it may be used to “exhaust” the land, as it is called—and may therefore with reason, under certain circumstances, be looked upon suspiciously and with dislike by the owner of the land. I would, however, just say this—that in the hands of an intelligent tenantry the means by which the greatest produce can be derived from the land are precisely those which the landlord should encourage. If I can obtain a large produce of food for man and beast, my use of it upon the farm will enable me to reproduce that plenty in the following year. We hear often that the mangold wurzel crop is more exhausting than the turnip. Of course it is; it would be strange if thirty tons of food taken off the land did not take more out of the soil than fifteen (and thirty and fifteen are about the relative yields of mangold wurzel and of turnip). But on the same rule a double crop of turnips would be more exhausting than a half one, and yet no one, whether owner of the land or cultivator of it, would lament the larger crop whatever effect of this kind may attend it. The use made of that crop upon the land will more than restore what has been taken from it. And whether the extra crop be produced by lime or in any other way, if the treatment of the land be in the hands of intelligent men, the greater crop, whatever be the means by which it is attained, is as much to the interest of the owner of the land as it is to the interest of the occupying tenant.

To return, however, to the practical details of liming. The question arises how it is to be done—whether, like Mr. Blake, we are to apply it once in every three years or once in every short rotation, or like Scottish farmers generally, as is justified by Mr. Watson’s and Mr. Hunter’s testimony to the long-continued influence of the application, once in every quarter of a century.

Certainly where the land has not had lime for a very long time—where there is none in the soil naturally—where there is a great bulk of vegetable matter in the soil which it is desired to get reduced to a rotten state in which it will provide food for plants—where the soil has been recently drained, having previously been injured by stagnant water, and therefore full of acid compounds which one would desire to see neutralized and decomposed at once—a heavy dressing of lime should be put on at once; and in that case it need not be repeated for a good many years; and the question is, whether after this first dressing, and after this long interval of time has elapsed, it be advisable to continue the plan of having dressings at long intervals, or adopt that more common in the English counties, of more frequent dressings in smaller quantity. My own opinion

is, that the heavy dressing is the best. There is no doubt that it answers well though at a heavy cost—and it seems to be in accordance with these considerations—(1) that it takes 300 bushels of lime to add one per cent. to a soil ten inches deep; that thus it is only by heavy dressings you can get the lime which you want to act in contact with the material on which you desire its action; (2) that if in any way, whether by liming or otherwise, you can once obtain a heavy grain crop and a bulky green crop, it becomes the farmer's own fault, as I have said, if he does not by the heavier dressing of dung he can thus ensure reproduce heavy green and grain crops year after year in succession. That plan, therefore, which has the greatest immediate effect is the most desirable; and when to this we add the testimony which is so abundant to the long-continued action of a heavy liming, I think that it is to the interest of the farmer to lay on a heavy dressing at once rather than repeat a smaller dose at frequent intervals.

And this, notwithstanding the explanations which the chemist has to offer of the influence of lime upon the soil. Lime they say acts (1) by neutralizing acid nuisances in the land; (2) by facilitating the decomposition of vegetable fibre there; (3) by decomposing mineral matter in the soil; (4) by furnishing matters which plants actually require as food. All these purposes would be served efficiently, and would even need for their accomplishment a heavy dressing at once rather than frequent light ones. There is, however, an additional purpose served by lime on which Professor Way is inclined to build a great portion of the theory of its action. There is, as he has proved, an enormous quantity of ammonia present in ordinary soils, and the action of lime upon it will have the effect of driving this ammonia off—an effect not at all desirable if so much lime be added as shall dissipate the greater part of the store. And a small quantity at frequent intervals, perhaps even annually, would, so far as this relationship to ammonia is concerned, be the better plan. We must, however, after all, fall back upon the actual experience of the farmer as the only safe guide. Professor Way himself declares that the mode in which lime acts is not completely understood (neither the agriculturist nor the chemist pretending to this knowledge), and you will therefore find the general experience of a locality on this, as well as on other subjects, to be the safest guide. Variations from it should be cautiously permitted, however clearly they may be sanctioned by theoretical considerations. In a discussion on this subject, at a meeting of the English Agricultural Society, some years ago, Professor Way contended that a heavy dressing of lime would exhaust the soil of ammonia, and that an occasional dressing of thirty or forty bushels was all that in a chemical point of view was needed; while the practical men present asserted that even when a heavy dressing was supplied, the whole

effect was not apparent until the second course of cropping after it.

I shall proceed, therefore, on the supposition that a heavy dressing of lime is at once to be put upon the land, not to be followed by another for many years. Having determined the quantity which you shall apply (200 to 300 bushels per acre) the questions arise—Before what crop in the rotation it shall be added? At what time of the year it should be put on? and in what condition it should be mixed with the land? In answer to the last question, there are several considerations inducing one to apply it hot from the kiln. (1) There is much less to carry, for lime in slaking absorbs a large quantity of water; and (2) especially on clay lands, if not slaked until in compost with the clay, it does in slaking destroy the tenacity of the adhesive earth with which it is mixed; and (3) most of all, the chemical effects of the lime upon both the organic and mineral parts of the soil are much more energetic when it is mixed, whether slaked or unslaked, in a caustic state with the substances on which it is to act.

In any case, it is necessary that the land on which the lime is to be applied be drained either naturally or artificially, as, by water stagnant in it after recently slaked lime had been mingled with it, it would be only the more effectually sealed up against the influence of all tillage operations. Lime should certainly be put dry on a dry soil, or it will form a cement which would be fatal to fertility.

The time of year when lime is generally applied is determined simply by its being freest from other occupations. Cartage is easiest done in winter time, and if a quantity of vegetable mould, ditch parings, and the like has been previously collected (as on a headland of the field that is to have the lime upon it, it may, during winter, lie in a compost with this material, and when turned over after slaking there), it will furnish an admirable dressing for application to the soil some weeks previous to the seed-time. Another common plan, one, too, involving less labour than any other, is to lay the shells fresh as they come from the kiln in little heaps (one or more bushels each) at perch wide intervals upon the land, covering them over at once with soil, and leaving them until the first showers have slaked the lime, when they are at once spread and ploughed in with a shallow furrow. Either of these plans may be proper shortly before the seed time of any grain crop, and lime is better applied at such times than for green crops, to which heavy dressings of dung are more commonly given, on which lime would act wastefully. The question as to that period in a rotation when lime is best applied may, I think, be answered by a reference to the experience of Mr. Hunter, which I quoted before. He applied it in the autumn on his clover stubble previous to its being ploughed up for oats. Lime is, however, often put on a corn stubble, and ploughed in before

winter; thus giving it six months' mixture with the soil before manure is added to the land from the succeeding green crop. The object should be, I may say generally, to add the lime at a time when the soil contains most vegetable matter. If it be put on at a time when the soil is poor, there is the greater necessity for its then being previously mixed with vegetable matter in the form of a compost.

It is indeed in the application of lime to poor soils containing little or no vegetable matter that its chief abuse consists. Its application to poor soils will only more completely exhaust what little fertility they still exhibit—its application to wet undrained land is mischievous—and its application either immediately before or immediately after manures containing ammoniacal salts, such as well-rotted farm-yard dung and guano is wasteful;—these are the three chief abuses of which the practice is susceptible. It should not be applied until so many years have elapsed, as that the previous application may be supposed exhausted, nor then unless the soil contain vegetable as well as mineral matters needing disintegration and decomposition. If these circumstances exist, you may apply it with every prospect of success, the probability of which will of course be greatly increased by liberal treatment of the land in after years. Farm-yard dung will be found much more influential on the crops of land that has been recently limed than on land unlimed for years. It will be brought more rapidly into use.

As to the cost of the operation, that varies so much that it is impossible to give figures that would prove of any use. It is made up of the price at the kiln, which varies with that of coal and labour from 3*d.* to 6*d.* per bushel—of carriage, which depends upon the distance from the kiln—and of the subsequent manipulation, the laying it up in composts, or scattering it in little heaps about the field, and spreading from those heaps or from the carts upon the land. The whole cost may thus vary for a full dressing, of say 300 bushels per acre, from 40*s.* to 5*l.* per imperial acre. There are but two or three other points requiring notice here. I may mention, in the first place, as useful in any calculations on this subject, that one bushel of lime will weigh from 80 to 100 lbs., a cart load contains from 20 to 24 bushels, and a load of shells from the kiln will make between two or three loads of the powder after slaking. I may also refer to the well-known tendency of lime to sink in the soil on which it is applied, a tendency which should induce us to put lime in on a shallow furrow, and mix it thoroughly with the top soil. Lastly, I have not referred to the most common time of all for applying lime, especially to clay soils, viz., during a bare fallow, although that is my excuse for referring to this subject in the month of June. It is, however, certain, that on clay soils, drainage and good tillage will ultimately make the bare fallow unnecessary ;

and the place which corresponds to the fallow in a good rotation, viz., the autumn and the spring time previous to the seedtime of a fallow crop, has been already named as very proper for the application of a dressing of lime.

III.—HAY-MAKING.

This, in early districts and on irrigated fields for meadow hay, and everywhere for the clover and sainfoin crops, is one chief occupation of the month of June. The cost of mowing, hay-making, and building in rick, excluding the labour of the farm-horses in the process, may be put upon an average at 10s. an acre, for which the whole work will be undertaken on contract. Of course, however, it is more or less according to the weather, and consequent length and labour of the process. The more costly the work of making hay, the worse of course is the result. Bad hay costs most, and is worth least. Every improvement of farm management by which the extent of grass land mown for hay may be diminished is therefore to be welcomed. Cattle, if kept through the winter otherwise than on hay, will consume the whole produce of our grass lands in the field during the summer season, when there is less waste in the process of feeding, and when milk, one main produce of our grass fields, can be most profitably converted. The use of the root pulper, to which reference is elsewhere made in this Calendar, enables the greater consumption of straw in the feeding-house during winter, and so dispenses in great measure with the need of hay, and there can be no doubt that less hay is year by year being made. The process is, however, laborious and costly enough, as well as sufficiently expensive, to render any cheapening of it that may be possible extremely desirable. And by horse-drawn mowing machines, and hay-tedders, and horse-rakes, we have certainly a very material improvement of the old style of management.

There is no recent addition to agricultural machinery of which a more uniformly good report is given than we everywhere receive of the mowing machine. Of a later date, and having to deal with a more succulent, and often a more tangled produce than the reaper, it has, nevertheless, at once leaped into almost universal favour, and is everywhere admitted to do its work better than the scythe. Burgess and Key's mower, Wood's mower, Ball's mower, made by Mr. Samuelson, of Banbury (and there are many others less well known), all do admirable work. Having officiated in the judgment of these rival implements when competing for the prizes offered by our great Agricultural Societies, and been often present at their competition before others, we can speak with confidence of the great difficulty of placing them upon the scale of merit; and where

the work is in ordinary cases done by all of them better than it is done by hand, the choice will be determined rather by facility of purchase than by any other circumstance. There is a large collection of evidence, all indicating the great advantage of the mower whether in rapid or in difficult harvest weather, published in the 9th volume of the *Bath and West of England Agricultural Society's Journal*. We quote the letters of two of that Society's correspondents. Mr. Harrison, of Frocester Court, Gloucestershire, says :—

“I have used Wood's mower of 1860. It is an excellent implement, and the work done by it is equal to any done with the scythe. It is a simple machine, well designed, and easily managed, but I think too slightly constructed. As to efficiency, a better machine could not be wished. In fine hay-making weather, from the grass being at once tedded and exposed, the labour of hay-making is prodigiously diminished, and with the aid of the hay-making machine and horse-rake, the chief manual labour consists in gathering it together and securing it in the rick. In catching weather the farmer is much more independent of the weather, as with the knowledge that he can cut down eight or ten acres, or even more, per day, he ceases mowing till the weather promises to be fine. Last year (1860) was exceptional, and, excepting the fine fortnight at the beginning of July, it was impossible to make really good hay in our district ; but to show the importance of the mowing machine, I know that on more than one estate where they were used, and plenty of hands could be drawn for the occasion from the estate to assist at the hay-making, the whole of the hay was secured during the fine weather in first-rate order.”

Of Burgess and Key's mower, Mr. Horswell, of Tavistock, says :—

“It answered admirably, and though the season was very bad, I never saved hay in better condition, or with so little labour. During the eight days' uninterrupted fine weather in July (the only fine weather for the season), when men could be scarcely obtained, and for the mere labour of cutting 8s. or 10s. per acre had to be paid, I got in fifty-six acres with the aid of the mower, hay-tedder, and hay-gatherer—the cost of manual labour in getting it ready to be carried did not exceed 1s. per acre), and it had no rain upon it whatever—and there were twenty-four acres besides with very little damage, all secured before the heavy rains set in. Without the aid of machinery, twenty or thirty out of the eighty acres would be the most that I could have possibly saved in good condition. Where the surface is moderately even, we can set the machine so low as to cut four or five cwt. of hay per acre more than the best men can do in the ordinary way. Since I have availed myself of the machinery that there is to aid the agriculturist, I can comfort-

ably complete my harvesting with the labourers regularly employed on the farm."

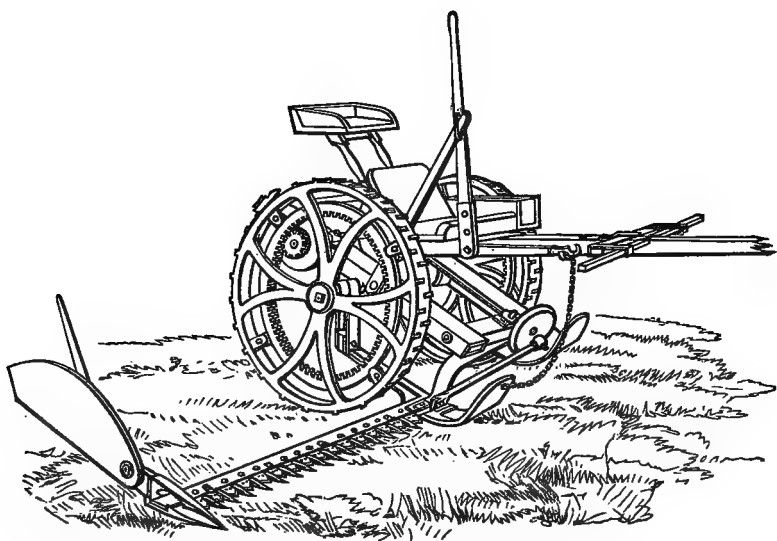


Fig. 49.—Cranstoun's (Wood's) American Mower.

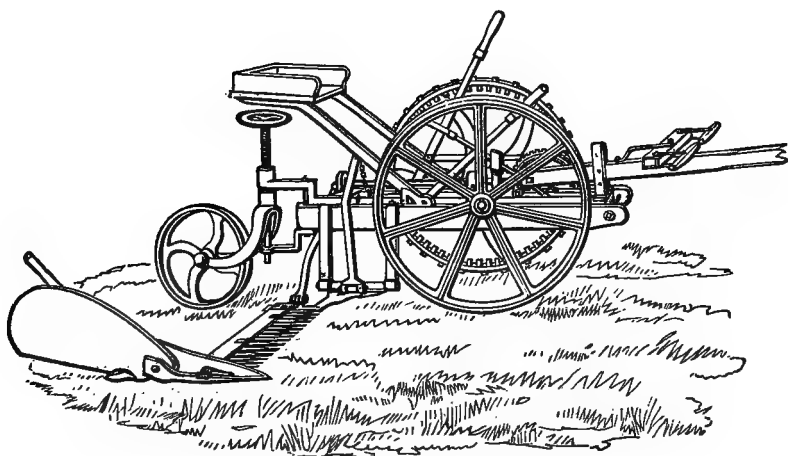


Fig. 50.—Burgess and Key's (Allen's) American Mower.

The figures 49 and 50 represent Cranstoun's (Wood's) American mower, and Burgess and Key's (Allen's) American mower. The former is of the simpler construction, with only one lever for adjustment to its work. Made in America, it is perhaps of slighter build than is needed for English crops. The cutting part rests on the ground, on one side of course, but in front of the driving wheels, whose force tends therefore rather to dig the cutting edge into the ground, and aggravate any tendency it may have to catch the soil. The latter is home-made, and of excellent workmanship, stouter and stronger, furnished with several adjustments—as a screw, seen in the drawing, for raising and lowering the hinder end of the frame—a lever by which the driver can back the machine out of its work—another by which the cutting blade can be lifted—and a third by which the whole is put out of gear. The machine is rather heavier to draw than Cranstoun's. Its cutter, as will be seen from Fig. 50, hangs on one side of course, but *behind* the driving wheel, so that any obstruction tends to lift it out of work, and so to mitigate the mischief. The awards of judges, at the trials of these novel machines, have been sometimes on one side, sometimes on the other. Both are most effective implements, and deserve general adoption.

In Samuelson's mower, the cutter hangs loosely from the framework of the machine, fitting the surface on which it lies, being doubly-hinged for this purpose to that part of the machine to which it is attached.

The cost is 22*l.* to 25*l.* The cost of Cranstoun's machine is 22*l.*; that of Burgess and Key's is 30*l.*

The letters given above are conclusive testimony to the value of the machine upon the farm at this time of the year. It and the hay-tedder have certainly wonderfully diminished the labour and anxiety of the grass-land farmer in the summer months. And they have saved his pocket, too, not merely by the larger quantity of good hay he can make, but by the direct saving of wages hitherto paid in the harvest field, which will now be paid for the more efficient tillage of plough land crops.

A good paper on hay-making was read last year (1860) before the Dublin Agricultural Society by Mr. Baldwin, of the Glasnevin College, in which the proper time, method, and cost of hay-making are discussed. The following are one or two of the conclusions he arrives at:—

On the Time of Mowing.—As all grasses do not bloom at once, it is necessary so to time the mowing that the majority of the plants present in the swathe shall be at their best. The following rules are a sufficient guide:—

In the case of Italian rye-grass always mow on the appearance of the flowers, as this grass is such a fast grower, that, if cut at

this stage, a second cutting is obtained equal to the first, and, on good land, a third and fourth very little inferior. Ordinary rye-grass may be allowed to produce the flowers. Clover is best cut when the heads are in full blossom. Mixed meadows should be mown when the bulk of the herbage is in full flower, or when the seeds of the earliest grasses are fully formed, such as sweet-scented vernal grass (*anthoxanthum odoratum*), meadow fox-tail (*alopecurus pratensis*); and the late grasses, as crested dog's-tail (*cynosurus cristatus*), and meadow fescue (*festuca pratensis*), are just beginning to produce the floral organs. With us, Timothy (*phleum pratense*), Italian rye-grass (*lolium italicum*), perennial rye-grass (*lolium perenne*), and cock's-foot (*dactylis glomerata*), flower during the latter half of June, which, as these grasses constitute the great bulk of good meadow land, is our mowing season.

As to the Cost of Mowing.— This will vary from year to year, according to the crop and the abundance of mowers, more than 100 per cent. It is amazingly cheapened by horse-drawn machines, and the following valuations may be accepted as near the truth. For mowing a heavy crop of grass :—

1. By manual labour—say	4s. 6d.
2. By mowing machine—	
Manual labour	3½d.
Horse labour	6
Per centage per acre	9
	1 6½

This gives a gain of 3s. per statute acre. If (says Mr. Baldwin) we assume the saving effected by the machine at 2s. per acre (and any calculation on the subject is only approximate), we find that the introduction of this machine on all the meadow land of Ireland (supposing the ground sufficiently even for the purpose) would effect a national saving of 150,000*l.* annually! The saving over the greater extent of grass lands in our own dairy counties would, of course, be proportionately large.

The Making, again, is a process cheapened by the use of the hay-tedder and horse-rake—so that from 8s. to 10s. per acre for good hay in good weather, and 10s. and 15s. for inferior hay in bad weather, as the whole cost of it when in the rick—the expense may be reduced 3s. or 4s. where mowing and other horse-drawn implements are used. The process essentially consists in so separating and scattering the grass after mowing that no two blades shall cling together in drying. It is perpetually tedded and shaken out as long as it is drying, and gathered together during night or when left for any length of time exposed to the risk of rain; and as soon as dry enough it should be ricked. The practice of letting it remain too long in cocks in the field is injurious to it.

Mr. Baldwin calculates that in the sister-island the loss in this way is something enormous. He says:—

That a considerable quantity of hay is lost annually, by being allowed to remain too long in cocks in the field, is a fact patent to anybody who has travelled much through the country. Within the last three or four years we have made agricultural tours through twenty-five of the thirty-two counties of Ireland; and from careful consideration of the subject, and having in some instances used a tape-line and weighing-machine to assist our judgment, we have come to the conclusion that one-twentieth of the hay crop of Ireland is permitted to rot in field cocks. The portion on the ground, as well as that on the outside of the cocks, is too often only fit for manure. And the loss of aftermath, and of the subsequent year's crop (if hay or pasture), suffers to the extent of from 6*d.* to 1*s.* per acre. If we unite all these sources, the loss sustained annually in this country is something serious to contemplate. On an average for all Ireland, it is not under twenty per cent., or a fifth of the actual value of the crop. We have about 1,500,000 acres under meadow in Ireland, the average produce of which, last year, was two tons per acre. The total hay produced was 3,000,000 tons; the value of which, at the current rate, would be, at least, 12,000,000*l.*; one-fifth of which = 2,400,000*l.*, is, as we have shown, lost by mismanagement to the Irish farmer.

Of course a similar loss of hay occurs on this side of the channel, also, wherever loss of time is allowed. The best hay will be made by those who remember that hay-making is merely a process for so treating grass as that it may be stored in safety. If every blade of grass could be exposed as soon as cut to a temperature under 200° until perfectly dry, and then packed away under a waterproof roof, the hay would be as good as such grass could yield. The whole nutriment which the grass contained would be present in the hay undiminished by wasting or by fermentation; and the nearer that our hay-making approaches this the better will its produce be.

The following passage, from the original edition of this work, describes the process as conducted in the Home Counties, where the practice is best understood, and the best hay is made.

The very early or rich meadows, and the highly manured upland pastures, about great cities, will be ready to mow in June. In executing the work, observe particularly that the labourers cut as close to the ground as possible: grass never thrives well that is not mown quite close, and the loss in the crop of hay is very considerable; for one inch at bottom weighs more than several at top. In the making it into hay, you will be a loser if you have not many hands ready for the work. It should be shaken out directly after the scythe; wind-rowed, that is raked into rows, before the evening, shaken out again next morning, and in the afternoon got into grass

cocks: these should be opened the morning following, and got into the great cock by night; by which time the hay will be well made, if no rain comes; but, in case of bad weather, the process will be more tedious. If successive rains come, so that the hay is damaged, and you are fearful of its turning out unprofitably, by all means salt as you stack it; a peck strewed in layers on the stack to a load of hay: it will have a very great effect in sweetening, however bad it may be, even to blackness; and it has been found by experiment, that horses and horned cattle will eat damaged hay salted, which they would not touch without that addition.

The following is the process of hay-making in Middlesex.

In order that the subject may be more clearly understood, I shall relate the particular operations of each day, during the whole process, from the moment in which the mower first applies his scythe, to that in which the hay is secured, either in the barn or in the stack. Before I enter more immediately on this task, I would just premise a few observations—viz.:

When the grass is nearly fit for mowing, the Middlesex farmer endeavours to select the best mowers, in number proportioned to the quantity of his grass, and the length of time it would be advisable to have it in hand; which, having done, he lets it out to be mown by the acre.* About the same time he provides five hay-makers (men and women†) to each mower. These last are paid by the day, the men attending from six till six, but the women only from eight till six: for an extra hour or so in the evening, when the business requires despatch, they receive a proportionate allowance.

The mowers usually begin their work at three, four, or five o'clock in the morning, and continue to labour till seven or eight at night; resting an hour or two in the middle of the day.

Every hay-maker is expected to come provided with a fork and a rake of his own; but when the grass is ready, and labourers scarce, the farmer is frequently obliged to provide both: but for the most part only the rake.

Every part of the operation is carried on with forks, except clearing the ground, which is done with rakes, and loading the carts, which is done by hand. Having premised so much, I now come to the description of the business of the

First day.—All the grass mown *before* nine o'clock in the morning is tedded (or spread), and great care taken to shake it out of every lump, and to strew it evenly over all the ground. Soon afterwards it is turned with the same degree of care and attention; and if, from the number of hands, they are able to turn the whole again,

* Each man mows from an acre and a half to an acre and three quarters per day: some there are who do two acres per day, during the whole season.

† Including loaders, pitchers, and stackers, and all others: but this is, of course, now altered by the introduction of the hay-tedder.

they do so, or at least as much of it as they can till twelve or one o'clock, at which time they dine. The first thing to be done after dinner, is, to take it into what are called *single* wind-rows;* and the last operation of this day is to put it into grass-cocks.

Second day.—The business of this day commences with tedding all the grass that was mown the first day *after* nine o'clock, and all that was mown this day before nine o'clock. Next, the grass-cocks are to be well shaken out into staddles (or separate plants) of five or six yards diameter. If the crop should be so thin and light as to leave the space between these staddles rather large, such spaces must be immediately raked clean, and the rakings mixed with the other hay, in order to its all being of an uniform colour. The next business is to turn the staddles, and after that to turn the grass that was teded in the first part of the morning once or twice, in the manner described for the first day. This should all be done before twelve or one o'clock, so that the whole may lie to dry while the work-people are at dinner. After dinner, the first thing to be done, is, to rake the staddles into *double* wind-rows;† next, to rake the grass into *single* wind-rows; then the double wind-rows are put into bastard-cocks; and lastly, the single wind-rows are put into grass-cocks. This completes the work of the second day.

Third day.—The grass mown and not spread on the second day, and also that mown in the early part of this day, is first to be teded in the morning; and then the grass-cocks are to be spread into staddles, as before, and the bastard-cocks into staddles of less extent. These lesser staddles, though last spread, are first turned, then those which were in grass-cocks; and next, the grass is turned once or twice before twelve or one o'clock, when the people go to dinner as usual. If the weather has proved sunny and fine, the hay which was last night in bastard-cocks will this afternoon be in a proper state to be carried; but if the weather should, on the contrary, have been cool and cloudy, no part of it probably will be fit to carry. In that case, the first thing set about after dinner, is, to rake that which was in grass-cocks last night into double wind-rows; then the grass, which was this morning spread from the swaths, into single wind-rows. After this, the hay which was last night in bastard-cocks is made up into full-sized cocks, and care taken to rake the hay up clean, and also to put the rakings upon the top of each cock. Next, the double wind-rows are put into

* That is, they all rake in such manner, as that each person makes a row, which rows are three or four feet apart.

† In doing which, every two persons rake the hay in opposite directions, or towards each other, and by that means form a row between them of double the size of a single wind-row. Each of these double wind-rows are about six or eight feet distant from each other.

bastard-cocks, and the single wind-rows into grass-cocks, as on the preceding days.

Fourth day.—On this day, the great cocks just mentioned are usually carried before dinner. The other operations of the day are such, and in the same order, as before described, and are continued daily until the hay harvest is completed.

In the course of hay-making, the grass should, as much as possible, be protected both day and night, against rain and dew, by cocking. Care should also be taken to proportion the number of hay-makers to that of the mowers, so that there may not be more grass in hand, at any one time, than can be managed according to the foregoing process. This proportion, when the hay-tedder is not used, is about twenty hay-makers (of which number twelve may be women) to four mowers: the latter are sometimes taken half a day to assist the former. But in hot, windy, or very drying weather, a greater proportion of hay-makers will be required than when the weather is cloudy and cool.

It is particularly necessary to guard against spreading more hay than the number of hands can get into cock the same day, or before rain. In showery and uncertain weather, the grass may sometimes be suffered to lie three, four, or even five days in swath. But before it has lain long enough for the under side of the swath to become yellow (which, if suffered to lie long, would be the case), particular care should be taken to turn the swathes with the heads of the rakes. In this state it will cure so much in about two days as only to require being tedded a few hours, when the weather is fine, previous to its being put together and carried. In this manner hay may be made and stacked at a small expense, and of a good colour, but the tops and bottoms of the grass are insufficiently separated by it.

There are no hay-stacks more neatly formed, nor better secured, than those of Middlesex. At every vacant time, while the stack is carrying up, the men are employed in pulling it, with their hands, into a proper shape: and, about a week after it is finished, the whole roof is properly thatched, and then secured from receiving any damage from the wind, by means of a straw rope extended along the eaves, up the ends, and near the ridge. The ends of the thatch are afterwards cut evenly below the eaves of the stack; just of sufficient length for the rain-water to drip quite clear of the hay. When the stack happens to be placed in a situation which may be suspected of being too damp in the winter, a trench about six or eight inches deep is dug round, and nearly close to it, which serves to convey all the water from the spot, and render it perfectly dry and secure.

The Middlesex farmers are desirous of preserving the green colour of their hay as much as possible, though a lightish brown is

of no disservice to it. Hay of a *deep* brown colour, occasioned by its having heated too much in the stack, is said to weaken the horses that eat it, by promoting an excess of urine, and, consequently, it sells at a reduced price.*

In the making of hay, some attention should be paid to the quality of the soil, and the kind of herbage growing on it. The hard, benty hay of a poor soil is in little or no danger of firing in the stack; and should, therefore, be put very early together, in order to promote a considerable perspiration, as the only means of imparting a flavour to such hay, which will make it agreeable to horses and lean cattle, for it will be nearly unfit for every other sort of stock.

It is the succulent herbage of rich highly manured land that is likely to generate heat: of course, the grass from such land must have more time allowed in making it into hay. This the Middlesex farmers are perfectly aware of; and, when the weather proves moderately drying, they make most excellent hay. But when very hot or scorching, they, as well as most other farmers under similar circumstances, are sometimes mistaken. In such weather the grass becomes crisp, rustles, and handles like hay before the sap is sufficiently dissipated for it to be in a state fit to be put into large stacks. But if that be done when it is thus insufficiently made, it generally heats too much, and sometimes becomes *mow-burnt*.

The above remarks, though written so many years ago, are still essentially applicable. The differences in the process which have since arisen are owing to the more frequent and repeated use of the hay-tedding machine, in place of such a costly staff of hay-makers. This, and the mowing machine, and the horse-rake, of course have introduced a great change in the practice of hay-making; though it still depends on a repeated moving of the grass, so that it shall dry each blade by itself as rapidly as possible.

Of the hay-tedder we give a drawing on the opposite page as it is usually made.

Nicholson of Newark, Ashby of Stamford, and Howard of Bedford, are makers of good forms of it.

The revolving-rakes are now made in smaller portions, and arranged spirally around the rims of their several wheels upon a common axle, so that a smaller portion of the whole is at any time in operation. The teeth are kept rigidly extended by springs which allow them to yield if they strike the ground. The driving wheel can be geared one

* If you would make your hay come out of the stack of a fine colour, and the beauty of the flowers to appear, the hay you have shaken out of bastard-cocks to prepare for carting should be cocked in the heat, and remain till the next morning; then turn and open the cocks, for the air to take away the damp that is collected, which otherwise would heat in the stack, and, of course, the beauty of the colour would be done away.

way or another on to the shaft which carries these teeth or rakes, and so they can revolve against the movement of the machine when

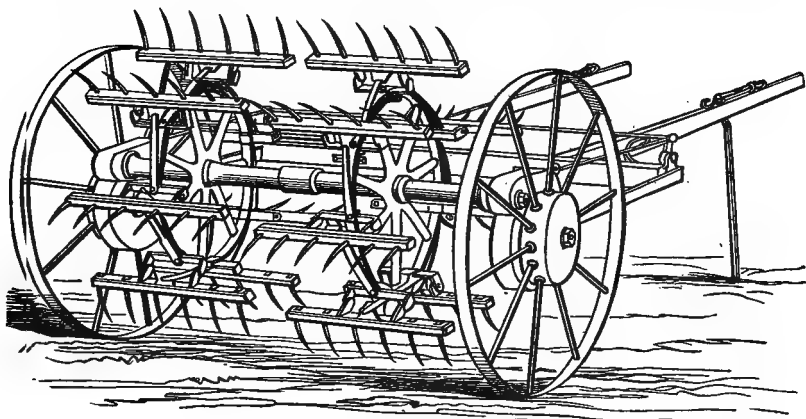


Fig. 51.—Hay-making Machine.

a violent tedding is desired, or with it when it is merely desired to turn the swathes without shaking them abroad. The cost of the hay-tedder is about 15*l*.

The mowing-machine and hay-tedder together prepare the grass for the horse-rake, by which it may be gathered into "wind-rows," at first at narrow intervals and in small quantity together, which being next morning shaken abroad again, may towards evening be gathered into larger rollers and divided into cocks.

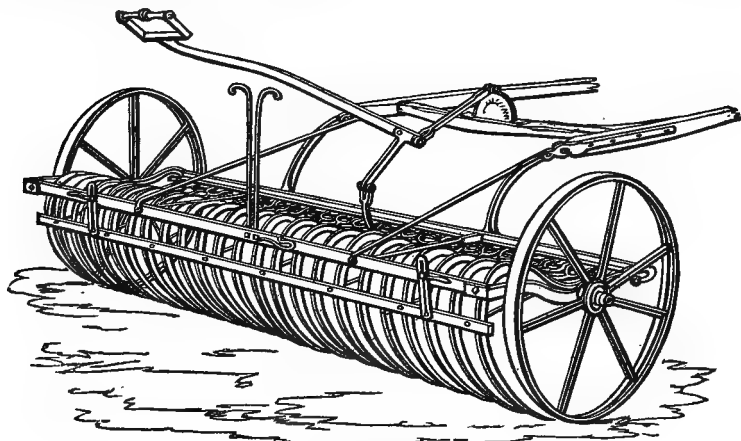


Fig. 52.—Howard's Horse Rake.

Various makers, as Howard of Bedford, Ashby of Stamford, Ransome of Ipswich, Hornsby, and Coultas of Grantham, and others, are known as makers of horse-rakes. They cost from 7*l.* to 9*l.*, and are a necessary implement of the farm.

The cost of haymaking varies exceedingly, according to the quantity of the crop and the nature of the weather. I have in Gloucestershire let hundreds of acres at 10*s.* an acre, for mowing, and making, and pitching to the waggon. And 10*s.*, with beer, is a common price for ordinary crops; such a contract is, however, a complete speculation on the part of those who undertake it; they will do well, and make good hay, if the weather suits them; but they will do ill, and make bad hay, if the weather is against them. Among the heavy crops of well-manured Middlesex farms, a guinea to 25*s.* and even 30*s.* are sometimes paid for making hay.

As to the practical details of hay-making it is necessary to add that, whether mown by hand or horse, clover mown for hay must not be shaken abroad. The swathes are turned the second or third day, and, perhaps, again turned the fourth or fifth day after cutting. They are then put in small cocks, and carried with as little rough shaking as possible, so as to retain the leaf unbroken. This rule applies also to the making of sainfoin hay.

IV.—TURNIP CULTURE.

The seed time of the turnip crop is through all the Southern and Midland Counties of England comprised for the most part within the month of June. In Scotland they try to get all their Swedish turnips sown in May, and the hybrids, yellow and white fleshed turnips, are got in this month, but it is found that early sown turnips are in our hotter, drier climate in the south, so liable to mildew if sown early, that Swedish turnips are rarely put in before the first and second week of June, and common turnips are sown all through the month of July. The management of the crop is of course the same in these cases as has been already described, except where turnips are taken after rye or vetches mown for forage or folded off. The land is then ploughed and cleaned as well as possible, cross ploughed, and again harrowed and picked. The manure is then carried on and spread and ploughed in, and the best plan of sowing is by the water drill on the flat, throwing in about three cwts. of superphosphate at the same time, and sowing in rows about eighteen inches apart.

In the month of June the earlier sown turnips will be brairding, and liable to all those evils which it suffers in that stage of its growth. The chief one of all is the attack of the turnip fly, and there are various ways proposed as a remedy. Perhaps the most satisfactory method of meeting the case is that described by Mr.

Fisher Hobbs a few years ago before the Royal Agricultural Society of England. He said:—

“I have no new theory to expound, but would only describe the result of my practice, and the policy of carrying out certain principles which have long been known and admitted, but not sufficiently observed. My remarks on the cultivation of the crop are intended to apply more to the Swede turnip than to any other varieties which are generally grown after green crops, but the great work of destruction by the fly is applicable alike to both. As ‘prevention is better than cure,’ I shall commence with the preparation of the land, assuming that this has been thoroughly under-drained wherever requisite. 1st. I consider that autumnal cultivation is essentially necessary; by broadsharing for the destruction of weeds and insects, as well as for the aëration of the soil. 2nd. Deep ploughing should follow, and subsoiling if required, and it is frequently my practice during the early part of winter to carry on to the land intended for a root crop the unfermented manure direct from the yards or sheds, and at once plough it in; but not a particle must be suffered to be seen on the surface; this I believe to be important, for if not attended to, the undecayed portion of the manure becomes a receptacle, and subsequently a nursery for insects. 3rd. At the commencement of spring it is most desirable, as soon as the state of the land will permit, to apply the harrows and roller, especially the former. I believe that more good may be done towards the destruction of insects of various kinds at that period than at any other throughout the year. Afterwards scarify, harrow, and roll until the land is in a pulverised state, and for a fortnight or three weeks before the time for drilling let the land remain like a seed-bed, so as to attract moisture, to allow vegetation for the seeds of weeds and for insects to deposit their larvæ; this is frequently termed ‘purging’ the land. I need not refer to the common mode of applying the fermented or partly rotted farm-yard manure for the turnip crop, except to state that it ought at once to be ploughed in, and the seed deposited immediately. 4th. At the time of drilling the seed it is best for the land to be ploughed (but some prefer scarifying only), and the seed to be immediately deposited. This is so important that I have frequently known total failures from the neglect of so doing. There is another point which I would strongly recommend, that is, in dry and sunny weather to plough and sow early in the morning and late in the afternoon, but never during the heat of the day. I know an instance where the most signal success has for several years attended this mode of operation, and where the manager has never failed to secure a plant, although he is one of the old school, and still sows the seed broadcast with his own hand. This can be confirmed by several large farmers in the neigh-

bourhood, who, strange to say, notwithstanding the example thus placed before them, continue to incur an amount of loss from having to sow two or three times, simply from the obstinacy and prejudice with which they continue to adhere to the customary working hours for their horses and men. 5th. At the time of depositing the seed it is my invariable practice to use some description of artificial manure, generally superphosphate of lime, and I likewise add about thirty bushels of ashes per acre, made from hedge trimmings, weeds, &c., collected upon the land at different periods throughout the year. The roller may now be used with great advantage, before, and sometimes after the drilling. In dry weather I strongly recommend the application of the liquid manure drill. 6th. Before or immediately the young plants appear, the horse-hoe should be resorted to for the purpose of destroying the ova or larvæ of the insects to prevent their coming to maturity. When once the plant is well up, the roller may sometimes be applied with much benefit, as it tends still further to disturb the insect tribe, as well as to retain moisture for the young plant, and to consolidate the farm-yard manure where lately applied. At this period the plant requires frequent watching throughout the day, and if the enemy shows itself in any force set to work quickly to accomplish its annihilation.

Having described to you briefly my mode of prevention, I will now proceed to give you the cure, which is simply by the application of one or more 'top-dressings.' I have tried various experiments, steeping the seed, and top-dressings for upwards of thirty years; but though sometimes successful, I could not depend on any of them until I adopted my present system; and I think it is only fair that I should state that I derived the chief features as to the use of this top-dressing from my late bailiff, Mr. O. Hawkins, who came to me some nine years since with an especial recommendation on this point: in fact, he himself engaged to secure the turnip plant from the ravages of the fly; adding, that he was willing to give up his situation immediately if he could not do so. I can only add, that for eight years, during the whole time he was with me, he fulfilled all he promised in this respect. The following is Mr. Hawkins's recipe for a top-dressing:—One bushel of white gas-ashes, fresh from the gas-house, one bushel of fresh lime from the kiln, six lbs. of sulphur, and ten lbs. of soot, well mixed together and got to as fine a powder as possible, so that it may adhere to the young plant. The above is sufficient for two acres when drilled at twenty-seven inches. It should be applied very early in the morning, when the *dew is on the leaf*—a broadcast machine being the most expeditious mode of distributing it, or it may be sprinkled with the hand carefully over the rows. If the fly continues troublesome, the process should be repeated; by this means 200 to 220 acres of turnips, Swedes, and rape have been grown on my farms annually for eight

or nine years without a rod of ground losing plants. The above is a strong dressing to be used when the fly is very numerous, and has never failed when applied at night. Numerous experiments have been tried, and amongst them I recommend the following in ordinary cases, and intend to use it during the present season if necessary:—fourteen lbs. of sulphur, one bushel of fresh lime, and two bushels of road-scrapings per acre, mixed together for a few days before it is used, and applied at night, either by means of a small drill, or strewed along the rows by hand. I have known sulphur mixed with water applied in a liquid state by means of water-carts during the night, and the horse-hoe immediately following the water-cart. This has succeeded admirably. In consequence of the dryness of the climate in my neighbourhood (the rain-fall being on the average only about sixteen inches annually), I usually sow on the flat; but the dressings above-named are equally applicable to crops sown on the ridge. I would strongly impress the necessity of frequently applying the horse-hoe. I am induced from the results of my experience to conclude that by care and attention the turnip plant may be as effectually and as certainly freed from the ravages of the fly as seed wheat has been for upwards of the last twenty years from smut and other destructive fungi.”

Mr. Fisher Hobbs’ scheme of top-dressing with a dusty compound the young plants when they are covered with the fly, has been cleverly carried out by Mr. Jephson Rowley, who has invented a machine for the purpose. It acts by throwing dust and lime upon the row of plants. This is not unfrequently done by hand, as Mr. Hobbs recommends, on a dewy morning; but to the slowness of any manual process there is the additional difficulty in the way of applying dust by hand against the fly, that in order to be effectual it needs to be distributed on both sides of the leaf. The machine is thus described:—

The lime (a mixture of one-sixth of soot with it is recommended) is thrown, by means of a blast fan, upon every part of the plant, both on the upper and under side. The fan is put in motion by the travelling wheels of the drill, and receives its velocity in the usual manner by multiplying wheels. The blast thus created by the fan is brought to bear upon the plant, which, yielding to its action, bends from the current, and as it acts upon a falling stream of lime or other composition the plant becomes completely covered with the powder.

It is in fact a two-rowed drill, provided with a fanner for each drill, drawing its supply of air from immediately above each row in advance of the machine, driving that air along a tube underneath the manure-box, and finally blowing it down upon the row behind the machine. In the course of its passage, and near the end of it, it traverses a quantity of falling powder delivered from the manure-

box in the ordinary way—lime and soot or any other thing that may be tried—and this is blown downwards upon the plants. The idea is, that the fanners when drawing in the air will suck the flies up with it and dash them in amongst the falling powder, and with it down upon the plant again in a thoroughly disabled, if not suffocated plight.

The fault no doubt is, that the horse which *draws* the implement will disturb the flies before the fanners reach them, and drive them out of reach of the sucking influence of the indraught to the fan, though whether they will have made their escape from the track of the falling powder may be doubtful. We are bound to add, that even though they should not have escaped so far as this, it must be still considered doubtful whether, thus enveloped in the dust, they are rendered altogether harmless; the invention has, however, already some satisfactory testimony to its efficiency.

The great remedy for the turnip fly is that which, by good tillage and a wet seed time and the use of seed enough, hastens growth through that early period when the leaves are still sweet, and the fly is therefore still dangerous to the plant. As soon as they have obtained their full-grown leaf they are comparatively safe, or only liable at any rate to other dangers.

It is proper to remark that Mr. C. Poppy has recommended for the preservation of a swede crop from the fly, that every tenth row or thereabouts should be sown with common turnip. He has alleged that the fly is so much fonder of the latter than of the former, that they will neglect the swedes until the turnip is consumed, by which time the other may have grown out of the period of danger.

V.—SUMMER CULTIVATION.

Besides the work of turnip cultivation, which is the main work of the month of June on arable land, many other crops will need attention.

Grain crops may still be hand-weeded, if necessary. In particular, plants of wild oats should be pulled out of wheat and barley crops as soon as they can be seen.

The young farmer will now be naturally led to watch the progress of his wheat crops; no accurate judgment can be formed till this month, which will enable him to make various observations which a man of any curiosity will not omit. Wheat which has carried a green and flourishing countenance throughout the winter, often loses its verdure in the spring, and assumes a yellow sickly aspect. On the other hand, with kindly weather in June, corn often surmounts the mischief occasioned to the blade by the vernal

cold, according to the old proverb current among the farmers, and expressed in these homely lines—

“ I came to my wheat in May, and went right sorrowfully away ;
I came to my wheat in June, and went away whistling a tune.”

After a dripping summer, bread corn is generally dear, as there is no weather so inimical to the wheat on the ground as wet, especially on the deep rich lands, where the largest crops are raised.

Crops of wheat do, however, sometimes turn out prolific after a wet summer. The year 1777 was one of the wettest that could have been remembered, and the spring had been uncommonly wet and chilly, so that the farmers, from the great abundance of straw, and from an observation of the unkindly state of the air throughout the summer, expected that their wheaten crops would turn out to bad account, and that, consequently, this grain would fetch an advanced price in the ensuing winter ; but the event falsified their prediction, and the unexpected fertility was occasioned by a kindly and favourable season at the blooming time, for in this year the wheat was very backward in coming out, and during the time it remained in blossom the weather was most favourable for that purpose, being, in truth, the only part of the summer unaccompanied with rain or wind. From these observations it may be deduced that when the wheat has a good blooming time, though the rest of the summer may have been unkindly, yet so much depends on the kindly state of the air at the blossoming season, that less danger need be apprehended to the crop from the weather in any other part of the summer. On the other hand, though the summer months may in general have been such as to promise a good crop of wheat, yet, should a wet and unkindly season intervene while the corn is in bloom, the produce will not be analogous to the general state of the weather during the greater part of the summer months, but to that particular prevalence of it at the time when the wheat was in bloom, a time whereon seems to depend the future welfare of this and every other vegetable grown for seed.

Beans may be horse and hand-hoed still ; the last process, to be done early this month, is earthing up the rows with a double mould board plough passed between them.

Flax should be hand-weeded carefully in June. The women and children go over the ground upon their knees against the wind, which will help to raise the bent plants.

Mangold wurzel should be horse-hoed this month, and singled out as soon as the leaf is as large as a child's hand. If the seed was dibbled in at the proper intervals, the bunches will have to be reduced to one plant apiece. If sown in rows, the plants are first bunched out by the hoe, and then singled by hand. The intervals

should be from twelve to eighteen inches, according to the probability of a vigorous growth. When the ground is likely to result in a heavy crop, the wider interval is to be preferred. Fifteen inches is a good average interval.

Rape, when early sown, will, if it has come up thickly, need a rough harrowing to thin the plants.

A horse-hoeing should be given to the ground, and a rough singling by hand-hoe, leaving two or three plants together in every eight or ten inches will be advantageous.

Lucerne, drilled in the spring, will now want a very careful attendance. The hand-hoes should be kept diligently at work; the land kept throughout this month perfectly free from weeds, and the surface well broken by the hoes, to prevent any binding of surface. While the men are hoeing, they should never omit to stoop and pluck out such weeds with their fingers as grow among the plants in the rows. Whoever cultivates lucerne must absolutely determine to spare no expense in the eradication of weeds. There is no plant will bear the neighbourhood of weeds so badly, and especially while it is young. If the hand-hoes are applied in time, and often enough, the expense will not be great; but if, through saving, you defer it till they are gotten much a-head, the crop will either be lost, or the expense of cleaning enormous.

The old crops of drilled lucerne will be ready for cutting this month.

Carrots should be horse-hoed and singled, and if parsnips have not before been singled this should now be done.

The white Belgian carrot, grown in rows eighteen inches apart, should be singled out to at least six inch intervals.

Cabbages are very largely grown by being dibbled in upon the flat after early tares which have been mown, the land having since been heavily manured and cultivated.

When the manure is spread and turned in, the proper way of planting is to send women or children in with bundles of plants, to drop them in rows three feet apart, at about two feet distances. They will thus lie ready for the men, who may then plant almost as fast as they can walk: but, if they have to get, carry, and set the plants, they will not be able to do near the work they might with better contrivance. It is a rule among the cabbage planters in husbandry, never to water the plants, let the season be as dry as it may, insisting that it is entirely useless. And if the land is in fine tilth, and well dunged, this is right.

The work of providing plants, transplanting, and making good plants by a second planting, if necessary, is often contracted for at the rate of about 25s. per acre.

There is one use in cabbages, which appears not to have met with the attention it merits: it is the planting on those lands where

turnips have failed. A late sown crop of those roots comes not often to a profitable amount; but cabbages thus planted on the land, without any fresh ploughing, would turn out a beneficial crop for sheep late in the spring: in all probability (unless on very light, sandy, or limestone soils), of greater value than the turnips, had they succeeded.

The cabbages planted in April, and hand-hoed and horse-hoed in May, should now have the second of each of those operations given: a hand-hoeing in the middle of the month, which must cut up all weeds, and break the earth well of the narrow slip on which the plants were left. Towards the latter end, the double mould-board plough should go in the intervals, splitting the ridge thrown up in May, and returning it to the rows. These operations will be of great utility to the crop.

The cabbages drilled in April where to remain, will demand much attention this month, to keep them at a proper distance; the tops of the ridges should be well hand-hoed, and the intervals skimmed, that they may be gradually reducing to a fine state of pulverization. In all horse-hoed crops, these works should be particularly attended to while the plants are young, for when they are much branched out, the work cannot be done with any thing like the same effect.

The Hop Farm.—The chief work in hop grounds is the completion of the second digging. This is followed by taking down the large poles from the weakly looking hills, and replacing them with small ones. After the poles have been exchanged in each hop ground, the superfluous bines which lie upon the ground are cut off. The plants are then hilled, or earthed up like potatoes, and the ground is again moved by an instrument termed a beck, which brings the land into a fine and deeply pulverized state. The intervals between the hills are then nidget. The nidget is a kind of scarifier, which deeply pulverizes the ground. Weak hills may be manured with an extra dressing of guano.

VI.—THE LIVE STOCK OF THE FARM.

The Dairy.*—Care should be taken during the warm weather of this month that the cows should be in pastures with convenient shade, or their constant uneasiness from the teasing of flies hinders their feeding, and their becoming so heated from running has a very injurious effect on the milk, which is less in quantity, very soon becomes sour after being taken from the cows, and does not yield nearly so much produce, and hence considerable loss arises. If the herd be brought into yards to be milked they should have the shade of cool sheds, or the operation of milking is very tedious

* Gloucestershire dairywoman in the *Agricultural Gazette*.

from the cows not standing, and often much milk is spilt from the awkward moving of the cows, and the whole is not taken from them, which it is sometimes under these circumstances almost impossible to do. This on every account should be avoided, for the milk that comes last is the richest, and besides, if the cows are not clean milked, there will be a gradual diminution of the milk perceptible daily; for these reasons the greatest care should be taken that the cows are clean milked. A sufficient number of milkers should be provided to allow the cows to remain only one hour in the yard; eight is about a proper number for a good milker to do well within the hour. If a sufficient number are milked to employ a man to carry in the milk to the dairy, it has been found to save much trouble; this man, with yoke and buckets, should go round to collect from each milker as his pail becomes nearly full, and so lighten each one's load to carry from cow to cow, and prevent their individual journeys from the yard during the milking hour; by this means the milk is taken to the tub or vat in a much more equal temperature than if longer exposed to the heated atmosphere in the pails; and such a precaution has been found to act well on the cheese and butter produced from it. When the cows have to be pastured far from the homestead, it is sometimes desirable to milk them in the field, for a drive along a hot road exposed to the sun does as great harm to their milk as racing about the fields when exposed to the sun. A vessel is then taken on wheels drawn by the milkers or a horse, according to convenience, and this should be left to stand in a cool spot, and be taken home steadily with as little shaking as may be.

The cows should get a change of grass once a week, even if to no better pasture; they are found to feed better and keep more settled than if left longer in one field. A good supply of fresh good water for them is indispensable for their doing well and yielding a quantity of milk.

The weaning calves may now be gradually, according to their age, doing without milk, meal, or linseed, if good pasture is provided for them by day, and they are brought into yards at night, then getting some Italian rye-grass given to them, which they will readily eat, and if a small quantity of dry hay or clover is supplied before they go out in the morning they will generally eat a little before they get any other food; and this is found very beneficial. The moisture from the grass and Italian rye-grass at night is found quite sufficient without water, to which they should not be allowed unrestrained access, or they drink to excess, and much harm is the result. Of course the linseed or oatmeal and skim milk may be continued to them with advantage, but they will grow strong without it at this age. Calves, to be kept in an improving condition, and to come out ready for the butcher towards the beginning or

middle of their third year, should have a pound of wheat daily allowed them in the field during their first summer.

Fatting cattle, if out at grass (and when the farm has good grazing grounds, and the farmer is a good market man, there is no more profitable method of making beef), should be so thinly spread over the pastures as that there may always be a good bite. It is ill policy overstocking the land.

Soiling cattle.—This practice is on most arable farms, especially where provision is made of crops near the feeding boxes and yards for carrying it out, a profitable method of increasing the store of manure upon the farm. Where Italian rye-grass and lucerne and clover, liberally treated, are near the feeding-house, cattle can be fattened during the summer months more cheaply than during winter, with at least as great advantage to the fertility of the farm. The practice is very warmly advocated in the earlier editions of this work, as follows:—

Enlightened farmers have in many districts adopted this system for horses, but still reject it for cattle; and it will probably take a century to render it as universal as it might be, most profitably. The objections to it are not of any importance: it has been argued that the expense is an object, and that cattle will not thrive so well, nor will cows give so much milk, as if fed in the field. That the expense is something cannot be denied, but that it amounts to anything considerable, is contrary to fact. Mr. Mure fed 240 fatting oxen in sheds through a whole summer by the mowing of one scythe; if the attendance upon the beasts be added to this amount, the whole will evidently come to the sum which, when divided either per head or per acre, will be so low as to do entirely away with this objection. As to the question of thriving, the assertion has been made, as far as it has come to my knowledge, without a trial, and is consequently mere theory. The beasts mentioned above were all sold fat at Smithfield, and did as well as similar beasts had done fed abroad in the most favourable seasons, and better than in any summer not remarkably favourable. I practised it for several years together very carefully for fatting cattle, weighing alive periodically, both while in stalls and when at grass, and I found that in soiling they throve better than when abroad. If the world will reason upon every question of farming, they should do it without prejudice, and then their reason would, to my apprehension, agree with these facts. Every one knows how tormenting flies are to cattle when abroad: ride into a field in summer to look at stock, and where do you find them? Not feeding, but standing or resting under trees, in ponds, in rivers, and, if there is no better shelter, in ditches under brambles; in a word, anywhere but feeding in the open air. What they graze is in the morning and evening; and in many cases they lose in the heat of the day all they gain at those moments of

their comfort. To this superiority we must add that of the main object, which is the dunghill: in one case this is accumulated in a degree even superior to what is effected in winter; in the other, it is scattered about the pastures, and nine-tenths of it carried away by the flies, or dried almost to a *caput mortuum* by the sun. The prodigious superiority of thus raising a large and very valuable dunghill in one case, and none at all in the other, ought to convince any reasonable man, that there is not a practice in husbandry so decidedly superior as this of soiling, were there not one other reason for it than what have already been produced.

Those farmers who have given particular attention to the state of farmyard manure, as it is made in winter and in summer, and to the efficacy of both, can scarcely have failed to remark that the superiority of the dung arising from any sort of stock in summer is very great to such as is made in winter from stock no better fed.

Cattle, when soiled upon any kind of good food, as tares, clover, chicory, lucerne, or grass, make so large a quantity of urine as to demand the greatest quantity of litter: the degree of this moisture, in which their litter is kept, while the weather is hot, much assists a rapid fermentation. On the other hand, when I view the common spectacle of a large yard spread with a thin stratum of straw or stubble, and a parcel of lean straw-fed cows wandering about it, I see the most ingenious way of annihilating litter, without making dung, that the wit of man could have invented. Burning such straw upon the land before sowing turnips, would be an application not inferior.

Cows thus managed are amongst the most unprofitable stock that can be kept on a farm. With the best food and management, their dung is inferior; but thus kept on a wide expanse of thin litter, well drenched in rain and snow, running to ponds and ditches, they destroy much, but give little.

There is, however, another fact of equal importance, that the food given in stalls or boxes goes so much farther than it will do when grazed where it grows; and when we recollect the old remark, that a beast feeds (or consumes) with five mouths, we shall not be surprised at this fact. A greater stock may thus be supported by the same farm, in one system, than there can be in the other.

Two circumstances demand attention, which, if neglected, will considerably lessen the benefit to be derived from soiling. The one is, to have a plentiful provision of litter; and the other, much care in feeding—to give the beasts but little at a time: if much be tumbled before them, it heats, they pick it over, and the waste may be great; and if a cart be left in the yard loaded, the contents heat, and then cattle will not eat it. A certain degree of care is necessary in everything: and in nothing more than in feeding all sorts of cattle. As to litter, it is an object of such importance, that

provision for the system should be gradually made through the winter, if corn enough be not left for summer threshing to supply the beasts. All dry vegetable matter, capable of providing a dry lair in stalls or boxes; leaves, in woodland countries; fern, dried peat, &c., should be thus collected against the summer months. An enterprising, vigilant farmer, when he has such an object as this in view, will exert every nerve to be prepared for a system the profit of which will depend so much on the care previously taken to be well provided with litter of some sort or other.

The first crops that will be ready for soiling are the rye, lucerne, and the Italian rye-grass, and the *trifolium incarnatum*; which may be supposed to last all the stock till the first-sown winter tares are ready, when the lucerne left uncut should be mown for hay. The second-sown winter tares come next; then clover, to be succeeded by the third sowing of tares, and by the second growth of Italian rye-grass and of lucerne. After this come spring tares, and the second growth of clover; and the third cutting of Italian rye-grass and of lucerne may follow. If chicory be applied to this use, for which it is well adapted, it will, on any good land, be mown thrice, and on very good soils four times. The quantity and value of the manure thus made will surprise those who have not witnessed it. Whether the stock be stalled or fed in boxes, or kept in well-littered yards, covered or open, in divisions, according to sort, size, age, fatness, value, or any other rule of separation, if they are fed carefully, have water at command, and are kept clean, all sorts will thrive to the farmer's satisfaction.

How fully all this is consistent with practice and experience, may be gathered from the following report of a week in June upon a farm in Buckinghamshire:—"Our horses are now living on tares, with half a bushel of beans and a bushel of rice-meal each per week. Twelve oxen are soiled in yards with grass and tares. The fatting oxen receive a portion of green food, with about 6 lbs. of meal per day. The fatting sheep live chiefly on tares, with nearly 1 lb. of corn per day. We sow salt over the tares, before the stock, to prevent hove and promote the health of the animals. We have had no hoven sheep this season, nor any diseased, from thriving too fast on green succulent food. A neighbour of ours, however, lost 22 sheep from inflammation, proceeding from eating too freely of tares, and caution is always necessary in changing stock from dry to succulent food, or *vice versâ*."

Horses do well on cut green food during June; giving them, in the first place, hay cut into chaff along with it, and the full allowance of corn so long as the labour of turnip culture remains to be done. In the more leisure month of July they may do on cut clover and without corn.

Sheep.—Sheep-washing and sheep-shearing are completed this

month. The first object is to provide a convenient place for washing. It is common for men to stand in the water for it, by which they sometimes get bad colds and rheumatic complaints, and must besides be supplied with gin: so disagreeably situated, they hurry over the work, and the wool suffers. A stream or pond offers the requisite opportunity for doing it well, and at the same time comfortably to the men. Rail off a portion of the water for the sheep to walk into by a sloped mouth at one end, and to walk out by another at the other end, with a depth sufficient at one part for them to swim; pave the whole: the breadth need not be more than six or seven feet; at one spot let in on each side of this passage, where the depth is just sufficient for the water to flow over the sheep's back, a cask either fixed or leaded, for a man to stand in dry. The sheep being in the water between them, they wash in perfection, and pushing them on, they swim through the deep part, and walk out at the other mouth, where is a clean pen, or a very clean dry pasture, to receive them. Of course there is a way to the tubs; and a pen at the first mouth of the water, whence the sheep are turned into it, where they may be soaking a few minutes before being driven to the washers.

The shearing is done after a few days, during which the sheep should be kept in a dry meadow. The yolk rises up into the wool, and both adds to its weight and improves its quality. The cost of clipping will be from 3s. to 4s. a score, according to the size of the sheep—in addition to beer.—(See *Calendar* for July.)

The fly.—Sheep that are kept in inclosures, and especially in a woodland country, should be examined every day; lest they be fly-struck: in twenty-four hours it may be almost past cure.

As a preventive of the fly, train oil is found to be efficacious; but it fouls the wool, and makes the sheep disagreeable to touch. An ointment made of butter and the flowers of sulphur, seems to be in good repute. When struck, a mercury stone rubbed into the place will destroy the maggots before they have done much mischief.

This may be the proper place and time too (for it is shortly after shearing time that sheep and lambs are dipped to kill ticks and lice) to refer to the subject of sheep-washes.

We extract the following from the columns of the *Irish Country Gentleman's Newspaper* of July 5, 1860:—

“By the term ‘sheep wash’ the flockmaster denotes those compositions which he applies to his flock for the purpose of preventing and remedying scab, the tick, the louse, and the fly. For use as a preventive the solutions are not necessarily made so strong, nor when applied for the destruction of the latter pests, as when used for the cure of that provoking and well-known disease, the scab. The term ‘wash,’ however, is scarcely definite enough, because

for the same purposes Highland flockmasters 'smear' or 'salve' their sheep with compositions in which tar and grease form the principal ingredients; and an unguent composed of mercurial ointment and lard is also successfully used. They are all applied either by rubbing in the compositions, or by immersing the animals in a bath prepared for the purpose. Ointments or salves, of course, must always be rubbed in, and, if applied soon after shearing, the operation does not occupy much time; but if the wool has grown, and it must be closely scored so as that the medicine may reach all parts of the skin, it is somewhat tedious. To facilitate the operation, and lest the composition should not be applied with integrity all over the body, the bath has been introduced, at one end of which is placed a horizontal drainer, resting on a shallow wooden trough, which conveys the drainings from the sheep into the bath, so as to prevent waste, the sheep being kept on the drainer for a few minutes. They should not be suffered to go on grass land speedily after being dipped, as disastrous effects have sometimes occurred from animals grazing on pasture where sheep were immediately allowed to roam after leaving the bath. There are some ingenious contrivances for facilitating the operation, by placing the sheep on its back on a kind of cradle, which is suspended by a rope from a sheave, and which can be lowered and raised at option into the bath, so that by merely holding the sheep in suspension over the bath the drainage can be effected to satisfaction.

"There is but little agreement as to the proper proportions of the constituents of the 'wash,' yet we find all agree that arsenic or mercury must hold a place in the recipe, although many laudable attempts have been made to substitute more innocuous medicines. For the destruction of the tick and louse, however, neither one nor the other need be used; but then the tiny *acari* dwelling within the skin are, in a great measure, saved from the destructive effects of the poison. Non-poisonous remedies have from time to time been trumpeted as discovered; but, as far as we can learn from all the extensive flockmasters we have consulted, the non-poisonous specific for scab is yet a desideratum. Simple cutaneous eruptions yield to sulphur, and most parasitic vermin succumb to tobacco water; but we have repeatedly proved that neither of these is adequate to curing the scab in sheep.

"We now give a few of the recipes usually employed for preventing and curing scab, &c.:—Finlay Dun recommends two lbs. each of arsenic, pearl ashes, soft soap, and sulphur, to be suspended in 100 gallons of water. This we have tried and found successful, but it discolours the wool.—Youatt's remedy was mercurial ointment, diluted with about five times its bulk of lard. This treatment we have also seen to prove effectual; perhaps its greatest drawback is the difficulty of applying it to all parts of the body, because the least

infected spot, if left untouched, will, in the course of time, after the medicine has become *effete*, again spread the contagion over the animal, and subsequently, as a matter of course, over the entire flock.—Hogg's ointment is composed as follows:—

“ Corrosive sublimate	8 oz.
White hellebore, in powder	12 oz.
Whale or other oil	6 gals.
Resin	2 lbs.
Tallow	2 lbs.

These substances should be mixed over the fire, and the sublimate after being pulverised, should be incorporated with the hellebore and a little oil before being added to the compound. This ointment, though dangerous, is an excellent remedy for scab; but unless the disease actually existed in an aggravated form, we should not give it a preference.—Martin recommends, with caution, half a pound of arsenic, mixed in twelve gallons of water.—We now detail our own practice in curing scab, which we are in a position to say proves highly effectual:—To ten gallons of tobacco water we add—

“ Corrosive sublimate	3 oz.
White arsenic	3 oz.
Sal ammoniac	3 oz.
Saltpetre	3 oz.
Spirits of turpentine	1 qt.
Starch	1 lb.
Pearl ash	1 lb.

The tobacco water we warm, adding the spirit of turpentine, starch, and pearl ash—the starch to keep the minerals in suspension—the pearl ash to prevent the yolk from weakening their power. And, subsequently, we add the minerals, after reducing them to a fine powder. This wash we apply, dependent on the season of the year, by hand, from a vessel with a narrow spout, or in the bath; in either case the body should be completely wetted, and, where the scabs exists, it should be rubbed with a knife, so as to produce a *slight* abrasion. The infected animals of the flock should be first treated, and the sound ones need not have the mixture so strong, which can be regulated by increasing the quantity of tobacco water. During the time of application, the mixture should be kept stirred. At the same time, all the rubbing places should be washed with the solution, and in about nine days the flock should be gone over again to see if the scab is lifting off, and the itchiness departing, and the skin assuming its ruddy colour,—the parts affected by the disease being of a greenish shade. There may be some obstinate cases which will require a second application; the parts should

again be slightly abraded, and the solution rubbed in. An ounce of sulphur, given daily, is also found to be of service.

“The practice of salving, so generally adopted in Scotland, might be extended with advantage to many of our hill flocks in this country. The price of the wool, no doubt, is lessened, but the increase in the quantity fully recompenses for this disadvantage, besides the increased health of the animals. Most Highland flock-masters have their own favourite salve; but the following, as recommended by Hogg, is in general use:—

“Train or seal oil	4 gals.
Tar	$\frac{1}{2}$ gal.
Oil of turpentine	1 pint.

This, mixed, is to be rubbed in after shearing. Dirty butter and tar also are used with effect as a salve. To remedy the depreciation in value of smeared or ‘laid’ wool, and at the same time to secure the advantages which the practice affords, many substitutes have been tried. The most successful we have known is Mr. John Godham’s, of Newbigging, who introduced resin instead of tar. His preparation is as follows:—

“Butter	18 lbs.
Hogs’ lard	18 lbs.
Resin	12 lbs.
Gallipoli oil	1 gal.

“An excellent mixture, to prevent ticks and fly-striking, may be prepared as follows:—To 10 gallons of tobacco water add 4 oz. of arsenic, $\frac{1}{2}$ lb. of soft soap, and 1 oz. of assafoetida, to be prepared and applied as the solution we have ourselves recommended.—Powdered white lead, applied to the parts where the maggots are found, is a capital remedy; the maggots, however, should be first removed by a pointed stick. But the scab-water we recommend is equally effectual, if poured on the part.—We have lately examined the sheep-wash compound prepared by the South Down Company, and have found it to be a concentrated essence of tobacco. This compound is in extensive use in the United States.

“It is worthy of remark that in these climates sheep can bear much more arsenic or mercury than in warmer and drier climates. The same quantities of these medicines which may be applied with impunity here would be attended with the most disastrous results in Australia.”

On the use of arsenical solutions for this purpose, it appears indeed from Australian experience, that in hot weather they are absorbed and act as poison, while in cold weather they are harmless, and act only in the manner for which they are applied. Mr. Young, of Kirkliston, thus speaks of his Australian experience:—

"There are two solutions which I have been in the habit of using, although not equally extensively, for reasons which will presently appear. One of these is made by dissolving from half an ounce to six drachms of arsenic in a gallon of water; and in a solution of this strength I have dipped as many as 2000 sheep a day, with, during cold weather, no fatal consequences ensuing. In warm weather, however, and especially if the sheep be in fine condition, the use of this solution is very dangerous; so much, that in one instance, on using, during the summer, a solution containing only two drachms of arsenic to the gallon of water, ten per cent. of the sheep (fat wethers) died. And as another instance, I may mention, that a neighbour, in December of last year (summer time in Australia), dipped a flock of picked ewes and lambs in an arsenical solution, the strength of which, however, I do not know, and the result was that 1300, being exactly one-half of them, died.

"The application of these remarks to a recent case (1859) *Black v. Elliott*, wherein nearly all the plaintiff's sheep died after dipping, is plain. They were in fine condition, and were dipped, during the month of August, in a solution containing half an ounce of arsenic to the gallon of water. The result was to have been expected."

The Ewe Flock.—The ewes from which it is proposed to breed early lambs for fattening early in the year should have the ram with them. Indeed, for the earliest lambs the ram is put with them in the month of May. The following remarks are from the same pen as described this management in early spring.

The breed of sheep kept for the rearing of early lambs is the horned Dorset, peculiar to the counties of Dorset and Somerset; we, however, sometimes meet with flocks of the same breed without horns, but they are quite an exception, and were originally propagated from the same stock. Early lambs are occasionally obtained from the Sowthdowns and other breeds, but after many years' futile attempts to obtain the early lambs as a rule from these breeds, it is now considered quite a hopeless case, and the horned Dorset is the only breed which can be depended upon for that purpose.

In selecting ewes of the horned variety, it is requisite that they should have been put to a Southdown tup, by all means chosen of good quality, being well made, short legged, and clothed with fine wool. The horned Dorset breed of sheep has been greatly improved within the last twenty years; but the number of flocks has been much diminished, having given place to the Southdowns upon the hill farms and in exposed situations. Formerly many flocks of these horned ewes were propagated almost entirely with regard to their milking qualities and propensity to produce twin lambs, in doing which the shape of the animal was comparatively disregarded. We still meet with flocks reared in the same manner at the present day; hence the necessity of the before-named selec-

tion. During the last twenty-six years I have continued to keep this breed of sheep, and I have found in some seasons, when my ewes have been ill-shaped, that they have yeanned an immense number of lambs, and have proved very milky, and made lambs of the first quality; they would not, however, fatten whilst suckling their lambs. At other times, when I have obtained the choicest description of horned ewes from the best districts of Somersetshire, I have found that they not only brought a large number of lambs, but that the ewes and lambs would both become fat and fit for sale at the same time, and in first-rate condition.

These ewes are sometimes sold in the spring of the year; but the usual period at which the breeders of this kind of stock offer them for sale is at Michaelmas, just before the time of lambing. Since, however, the number of flocks have been diminished, they have become comparatively dear, and it is therefore a common practice for some graziers to purchase and keep over for breeding purposes, the second year, those ewes which may, from circumstances, be found poor, or in merely stock condition in the spring of the year. The plan of breeding from the ewes the second season is found to answer a good purpose upon small arable farms having but little pasture land attached—it being the best policy to keep a stock flock in the summer, and a fattening flock in winter; for it must be borne in mind that this kind of sheep does not fatten readily during the summer months in the enclosed districts of the southern counties, because they feel the annoyance of flies more than most other breeds. The custom is to turn the tup with the ewes the first week in May; a short, fine-woolled sheep should be selected, in order that the offspring, more particularly in the case of twin lambs, which generally require to be kept a longer period, may possess a close coat, it being well known that loose hollow wool prejudices the sale of lambs in the live market. The tup should also possess good symmetry and plenty of flesh; a well-bred Hampshire down I have found better than a pure bred Sussex down, for the lambs reared from the latter do not possess a due proportion of lean meat, whereas those produced from the former are highly esteemed by the consumers of the present day, affording, as they do, a well combined proportion of flesh and fat.

The rams should be shorn about a fortnight previous to being turned among the ewes, and kept in an open shed up to that time, in order that they may gradually become accustomed to the loss of their coats; otherwise, in case of their being turned into the open field when recently shorn, they suffer in health and condition during the night frosts, which often happen in the early part of the month of May. When these ewes are kept entirely for the purpose of producing early lambs, they should never be shorn until the rams are taken from them, which should be done about the 20th of June;

in that case the portion of the flock of ewes which proved to be pregnant would finish dropping their lambs about the 14th of November. It is not advisable, in a flock of early stock, to have lambs fall after that period; for in case of ewes lambing later, they do not fatten readily with their lambs by their sides.

The manner of keeping the ewes will have its influence in inducing the ewes to offer to the ram at the earliest time. Although the nature of this breed of sheep will go far in this respect, yet circumstances often arise, such as the state of the weather, to delay the breeding season; yet this may in a great measure be prevented by generous keeping, and by choosing a sheltered situation for feeding them.

Let us now, as illustrating the contrast prevalent between the management of the ewe flocks at the two ends of the kingdom, turn to the case of the Lammermoor sheep farm already quoted in these pages. The following are reports from the district during June:—

June 1st.—The lambing season is now over. Though there was little or no vegetation till the beginning of May, and very little even then, the weather has been otherwise very good, having had scarcely a shower till the middle of this month. On a hill farm we never have lambs for ewes, there being generally from three to five per cent. of barren ewes. This year the deficiency is about six per cent., and on some farms where the ewes were very low in condition even greater. The lambs are healthy, and only require growing weather to make them strong and good. The Cheviot and crossed lambs (except the youngest) were castrated about the 10th. The wound is slightly anointed with sweet oil and turpentine to prevent inflammation. The ewe lambs get the stock and age mark at the same time. It is somewhat remarkable that among 600 hogs which have been wintered without turnips, there should have been only one case of sturdy or water in the brain. Is this unusual occurrence (on this farm at least) to be attributed to the jackets (see p. 246)? It is generally admitted that cold wet weather is the primary cause of this disease, from shedding the wool along the back, and admitting the cold and wet immediately on the spine. This evil is effectually remedied by the jacket, which does not admit one drop of rain. If this is one of the beneficial results of jacketing, the saving of sheep in one year will nearly provide all the cloth required.

June 16th.—The sheep are now beginning to recover the effects of winter, though we fear there will be a considerable loss of wool, and they will not be in a condition to clip for three weeks yet. The black-faced lambs were cut about ten days ago; these are generally the last operated upon; their horns, if cut sooner, being apt to grow in, and injure their eyes.

June 30th.—We are now engaged with the clipping, having made a beginning on the 24th of this month; the sheep were washed a few days before by swimming them three or four times through a

deep pool, by which means the wool is made very clean. It is the general rule in this district for neighbours to assist each other at sheep-shearing, arranging matters in such a way that each farm may have its own days. On the 24th inst., we had twelve hands at work, who began at seven o'clock in the morning, and finished about 600 Cheviot ewes and hogs by five o'clock in the evening, at which time they were stopped by rain. On the 26th inst., we had nine hands and finished 400 in the same time. A boy carries away the fleeces, another puts on the stock mark with pitch, while two women roll up the fleeces. We shall still have two days' clipping, one in the end of this week and another during the following. Having, in former years, found quick-lime strewed in the pens, an excellent preventive of the foot-root, we have had this carefully attended to.

The Sheep rot.—By far the most frightful of all the diseases to which our flocks are liable is the rot, of which the seeds are laid during the warm weather of May and June. Sheep have been known by a single access to a marshy field at this time of the year to have become affected with the rot, which has proved fatal during the following autumnal and winter months. The disease has been extremely fatal during the winter season of 1860, and unusual attention was then directed to it. Professor Brown, of the Cirencester College, contributed a very instructive paper on the subject to the pages of the ninth volume of the Bath and West of England Agricultural Society, and Professor Simonds gave a most instructive lecture on it before the English Agricultural Society. From the latter we take the following extracts :—

“The now generally received theory of the disease is founded entirely upon the existence of the fact, that during it we have certain entozoa (flukes) inhabiting the biliary ducts of the liver. These entozoa produce a number of eggs; these eggs pass out of the liver into the intestines, and are consequently expelled with the feculent matter of the sheep, in countless myriads. The original form of the theory was that healthy sheep, if put upon pasture grounds where these eggs exist upon the soil, receive them into their organisms; that the egg produces the fluke, and that the fluke would consequently find its proper *habitat*—that it would seek out instinctively the biliary ducts of the liver, where it would locate itself and grow to their own perfection and the ultimate destruction of the sheep; but it is found, that fluke eggs do not immediately produce flukes. Some ten years ago I put this to the test of positive experiment. I collected a great number of the eggs of the fluke—far more than it would be possible for a sheep to receive into its stomach in the course even of a summer's grazing. I took not less than a tea-spoonful of them, and it would be scarcely possible for you to count the number in a single drop of the water in which

they are placed under the field of the microscope ; and these, to the number of millions, I conveyed into the system of a sheep which I kept six months, and then had it destroyed. On examining its liver and other organs I found that there were no entozoa at all in the biliary ducts. In reality, there was not a single fluke produced from those millions of eggs so carried into the system of the sheep.

“The fluke or the *distoma hepaticum*, as it is called, is so designated from having apparently two mouths or sucking discs—one placed at the anterior part of the body, which may be truly regarded as a mouth ; and the other placed at a short distance below the neck, just where it terminates in the body. The animal inhabits the biliary ducts of the diseased liver ; and if we slit up these ducts in any case of this kind we shall find that they are filled more or less to repletion with these distomæ. They ultimately lead to an anæmiated condition of the entire organism. They not only feed upon the bile which is produced, but they alter the structure of the liver by their presence, just as we find with entozoa in other parts, and when this is the case it is of course perfectly impossible for the liver to secrete healthy bile, any more than pure water can flow from an impure spring. The bile plays an important part in the manufacture of blood, and if it is not in a healthy condition, pure blood cannot be produced from the food which the animal takes. The result is, that the entire organism is supplied with impure blood, while the system is being drained by the presence of these creatures. After a certain length of time we find that dropsical effusions take place, and then we have the disease established in all its intensity and in all its destructiveness.”

“It is not exclusively a sheep disease. These creatures have been found not only in cattle but in pigs ; in the ass and also in the human subject. They are very widely dispersed, but it is in the sheep in particular that they accumulate in such numbers as absolutely to produce this specific malady.”

“There is one circumstance especially which renders the ova of the fluke especially interesting to us, namely, that if we examine them never so carefully, and any number we please, those that have been naturally expelled from the creatures as well as those that are contained within them, we shall find that there never exists within the ovum anything of the outline of the young fluke ; and this fact being established, it is evident that in order for the fluke egg to produce ultimately a fluke, the germs contained within it must pass through a series of transmutations ; and it is by studying these that we can get at something like valuable information with reference to the manner in which these creatures are propagated. It is now several years since I thoroughly convinced myself of that fact, and I believe nearly every person who is at all observing or familiar

with the circumstance knows that if you slit up the gall ducts of sheep or any other animal affected with distoma, though you may see some of these creatures smaller than others, you never see what might be called a number of young flukes; nor will you be able to discover a young fluke by microscopically examining the bile in which they live. This then, together with the other circumstance to which I have referred, shows at once there is not a reproduction of the entozoa within the biliary ducts; so that (to put it in a practical way) supposing a sheep to receive six of these flukes into the biliary ducts, they would never multiply. They would deposit millions of eggs in the smallest ramifications of the ducts—instinctively deposited there, it would seem, for the purpose of preventing them from too readily flowing out by the functions of those organs—but you would never have more than six flukes. Now, what does this explain? It explains a fact of every-day occurrence. A person will often tell you, I sent a lot of sheep to the butcher; I never had more perfect and beautiful animals; they were as fat as sheep could be; yet the butcher found eight or nine, or ten or twelve flukes in the liver. The fact is, that here they did not exist in sufficient numbers to lay the foundation for disease. If it were otherwise, we can see that if one fluke only passed into the biliary duct it would multiply almost *ad infinitum*, and the animal must fall a victim to the affection induced thereby. Here then we have a practical result at once, arising with many others from an investigation of the natural history of this creature.”

“Now what I am going to explain will only allow of an analogy with regard to these creatures. We believe that each of these fluke eggs contains a number of moving ciliated cells, which are more or less round; that these creatures passing into water, for example, are set at liberty; that they become parasitic on some of the creatures which are met with in water, and that when so parasitic they have the capability of propagating themselves; that they subsequently pass through a series of changes, and again become, as we believe on analogical grounds, parasitic a second time on other creatures, when they change into the fluke-like form. So that tracing the process all through we should say that the egg sends forth a circular germ which is ciliated, and which has a rotatory motion in water; that in this condition it becomes parasitic on molluscs, small snails, and things of that description; that when it gets into the body of these creatures, working its way in just below the skin by the cilia which it possesses, it undergoes a perfect change, becoming something like a chrysalis, in which condition it propagates itself; that the creatures immediately coming from it reach a certain order of development in the snail; that they then escape from it in the form of the so-called *secaria*, swim about in water, and after a certain time again become encased, and again

become parasitic on the snail, in order, in reality, that they may reach a higher form of development ; they then remain in the water, attached either to plants, or to smaller creatures inhabiting water, especially slugs and snails ; and when these things pass into the stomach of the sheep they find their proper *habitat*. We now get them developed into flukes, and it is important to bear in mind that the last transformation takes place, not in the liver, not in the biliary ducts, but in the stomach of the animal. You will see presently what importance there is attaching to that fact, which has only very recently come to light.

“ Now, if we accept this as an approximation to the truth with regard to the development of these things, we shall find that it unravels the whole mystery with regard to rot.

“ It explains at once why certain districts are dangerous. It explains to us the occurrence which has been recorded over and over again, that out of 100 sheep, for example, 99 have strayed over a common, and that one has been accidentally prevented from doing so ; that subsequently the 99 have been attacked with rot, while the one that remained behind escaped. I now believe that it is perfectly possible for sheep to be free from the cause of rot at this minute, and to receive it at the next ; that is, if they are placed under circumstances where they can obtain these creatures in one of their forms of development ; and they must have reached a particular stage of development before they so receive them. Now let us suppose we have the *secaria* rolled up into the form of a creature something like a chrysalis covered over by its shell ; let us suppose that which is positively the fact, that hundreds of these creatures can be seen upon small molluscs, many of them also loose in water, that they are adhering likewise to plants and growing in damp situations ; then a sheep has only to drink a mouthful of water to take in an indefinite number of these little things, and, taking them into the stomach, they there become developed into flukes. We have, therefore, very good ground for believing that rot can be very readily and rapidly received. People want to know how it is that we get rot in certain seasons and not in others. Whenever there is an excess of moisture, certain pastures, which are perfectly free from the disease at other times, become affected. This is easily enough explained. We have seen that the ova of these creatures come out in millions from one affected sheep : what, then, must be the number of them in hundreds of sheep so affected ! We know not what is the duration of the life of these ova. It is possible that they may remain years without undergoing change, until placed under favourable circumstances to undergo that change. If, then, we look at the vast numbers in which these ova exist, and at their power of maintaining their vitality for a great length of time, we get rid of a considerable amount of difficulty. Then we find that

when you get an excess of moisture, and with that an elevated temperature, we have the living germs, that are separated by the bursting of the egg, set at liberty, and becoming parasitic on other creatures, as I previously explained, passing through that series of transformations comparatively quickly, and being very easily received into the system of the sheep. It is notorious that sheep placed upon watery-meadows receive the rot; but it is equally notorious that it is only at a certain period of the year that they will do so. You may, as every practical man knows, put sheep upon water-meadows during the winter months, or in the early part of the spring; but if you water your meadows in the month of May, and then get a luxuriant herbage springing up afterwards, and put the sheep on this, you are almost certain to rot them. As you approach Midsummer the danger increases; and as you approach towards winter it decreases. That single circumstance shows that, when there is moisture and heat combined, the cause is brought into operation. I have spoken of the great losses amongst sheep affected with rot. When were the sheep affected with rot that we are now losing? I answer, last Midsummer. That is the time to which you have to look. The cause was received then; the development has been going on in these creatures since that time. They have now attained their full size, and they are producing mischief in anæmiating the animals."

"With regard to the symptoms by which we recognise rot, it is universally admitted, I believe, at least by all practical men, that in the earliest stage there is no great depreciation of the value of the sheep, that it does not apparently suffer any inconvenience, but that it rather accumulates flesh faster. The explanation of this is easy enough. The small fluke enters into the liver, not perfected, but having of course to be perfected, and to have its generative system fully developed in the gall-ducts of the liver. When they first pass in, although, perhaps, in very considerable numbers, they simply act as a sort of stimulus to the action of the liver; they consequently call forth an increased secretion of bile, and as there is no alteration in the character of the bile, the sheep now being fairly supplied with an ordinary amount of food, will make relatively a larger quantity of blood out of that food. The liver being in a state of excitation scarcely bordering upon disease, the sheep will lay on a larger quantity of flesh. It is very difficult, therefore, for us to say what are really the early symptoms of rot, if we except this accumulation of flesh. There can be no doubt that in an advanced stage of the disease we take cognizance of the affection very readily; but unfortunately it happens that the symptoms which then show themselves are such as to prove to us that the system is breaking up, and that the time is past for curative measures. At first, I say, the symptoms are exceedingly insidious, but after a certain length

of time we find that such animals have an occasional cough, that their appetite is somewhat impaired and fastidious—to-day feeding pretty well, to-morrow scarcely at all. They will be easily acted upon by all external causes, and if exposed to wet and cold will suffer a great deal of inconvenience.

“Subsequently there is a gradual wasting of the body, and this takes place even before other symptoms which are looked upon as unmistakeable proofs of the existence of the disease show themselves, at any rate, to any great extent. It is always a suspicious circumstance if you find that animals have been remarkably well, and then towards the latter period of the year, when they should be going on maintaining their condition, they begin to waste. If you put your hand upon them and find them “lean on the back,” as it is called, that the vertebræ are sticking up, and are bare of flesh, if you find the animals “razor-backed,” if I may use the expression, it is a pretty good indication that they are affected. This state of wasting being once established, it continues, and we then get a pale state of the skin, which becomes of a yellowish tint, and very frequently it may be said that jaundice to some extent becomes associated with dropsy. If you open a sheep which is in a somewhat advanced stage of the affection, fat is particularly yellow. We afterwards find that the inner angle of the eye becomes exceedingly pale, so that when we evert and press forward the *membrana nictitans* of the eye, we find, instead of its being in a healthy condition, that it is covered with a number of red lines, marking blood-vessels through which the blood flows, but the blood being deprived of its red cells, the liquid is colourless, generally speaking. This evidently arises from the circumstance that there is a great drain going on upon the system, that the blood itself is being deprived of its watery matter, and that the watery matter must be taken up into the organism to make up for the drain. Then we find further, that as the disease advances, we get a variable state of fæces: sometimes they will be scouring, and at other times nothing of the sort will be observed; and it is always a suspicious circumstance to find sheep in the autumnal months *occasionally* scouring. Of course such animals lose their strength very quickly. They are dull, dispirited, and often found lying down. As the disease advances, the breathing becomes somewhat difficult; the wool is easily removed; oedematous swellings, as they are called, begin to show themselves and to accumulate in different parts of the body, more particularly under the lower jaw. These are nothing more nor less than dropsical effusions; the blood is almost changed into water, and then you have these swellings finding their way into the areolar tissue in different parts of the body, passing freely through that, and accumulating particularly under the lower jaw,

because the animal frequently has its head pendent, and in the act of feeding a gravitation of fluid takes place.

"The treatment, then, of rot, speaking of it as a curative treatment, must have for its end and object the removal of the cause; and if we have these entozoa, which are the proximate cause of the affection, all our efforts must be made to the displacing of them from the biliary ducts; though I believe if we take sheep in an advanced stage of this disease, and could destroy or remove from the biliary ducts every fluke contained in them, we should not save the life of the sheep, because the presence of these creatures produces mischief in two ways; it leads to organic changes in the structure of the liver, and the breaking up of the entire organism of the animal. We cannot put a new liver into the animal, and the powers of life cannot be supported by us long enough to bring it into a new state. But it is equally true that we must look to the causes, for the purpose of getting rid of the effects. There is no multiplication of these creatures in the biliary ducts. If, therefore, we were to adopt the treatment early in the case, when there are but few of these entozoa, it would necessarily be attended with success. We are to measure the danger of the animal by the number of flukes existing in the biliary ducts, and by the length of time that they have so existed. It is proved by daily experience that we can resist to some considerable extent the inroad of the disease, and we have therefore to look to the means which are at our disposal for the purpose of keeping the animal body together, if I may so express it, so that the ultimate loss shall not be very great. Now, how is this to be done? It is to be done, in the first place, wherever it is practicable (but it is not always so), by protecting sheep from the inclemency of the weather; and in the next place, by abstaining as much as possible from all succulent vegetable food, all food which has an excessive moisture. We should give the animals as much nitrogenous food as we possibly can, so as to lay the foundation for pure healthy blood; and we want at the same time to throw tonics into the system, with a view of medicinally strengthening it. What should these consist of? It is rather a difficult thing when a man has 500 or 600 sheep to be giving them tonic agents, and therefore we are obliged to choose something which will of itself be unobjectionable to the animal. Sulphate of iron is an excellent tonic for purposes of this kind. Not only is it a good invigorator of the system, but an agent which sheep will take readily; but it is to be borne in mind, that it is in itself a very great anthelmintic, and may do much good in that way. So that if in December or January I had taken a number of sheep affected with this disease, and the subjects of structural change in the liver, and given them nitrogenous food, protecting them as much as possible from the weather, and

giving them sulphate of iron; if I had husbanded the animals powers to the greatest possible extent, and added also, from time to time, some salt to their food, I have no doubt I should have kept them alive, and been able to sell them as fair food at a small cost in the market."

"I once purchased a lot of rotten sheep; I gave them no physic of any kind, but merely kept them in sheds during the winter time, fed them with corn and cake, giving the most generous diet I could; and I not only prevented the further progress of the disease in several of these cases, but I even made the animals accumulate flesh, and they went into the market in the following spring, forming pretty fair meat for the people. This shows what can be done by generous diet and a protection of the animals. When we have animals in this condition, there will be a great advantage arising from the employment of diffusible stimulants, and such as, to some extent, are more powerful anthelmintics. For example, we may use turpentine (which the animals must of course be dosed with) in conjunction with sulphuric ether as an invigorating agent and at the same time an anthelmintic. If I were to take half-a-dozen sheep, and simply give them sulphuric ether with oil of turpentine day by day, attending to those other things that I have mentioned, not neglecting salt as a stimulant to the digestive organs, I think it very likely that two or three of them (according to the stage of the disease) would be benefited by treatment of that kind.

"It is well known that sheep do not rot on salt marshes; no matter how wet they may be, no rot takes place on them. Now, what is the explanation of that fact? These infusoriæ that we have been speaking so much of are creatures belonging to fresh water, and not to salt water. If, therefore, we were enabled to take a quantity of salt sufficient to render all these damp swampy places in our meadows or pools completely salt, we should destroy the whole of these creatures, and so get rid of the cause of this affection. But we cannot do that; you could not have a sufficient quantity necessary for the purpose without destroying the whole vegetation upon the meadows. But bearing in mind the fact that the last change into the fluke takes place in the stomach, and not in the liver, and that salt is destructive of these infusoriæ, as we may call them, you will see that if you convey salt in sufficient quantity into the stomach, you may destroy them there before they undergo the last change. They undergo their last change, as I have said, in the stomach, and then as flukes find their way into the biliary ducts; but if you can prevent that last metamorphosis, you get rid of the cause. I believe, therefore, that rot may be prevented to a very considerable extent by the use of salt. When is the dangerous period to sheep? As you approach towards Midsummer We must prevent the disease, then, if we can; that is the time to

strike at its root. Now, what have we had in the past season (1860)? We have had a very wet summer. I happen to have been an unfortunate farmer—unfortunate, I say, because, like many others, I have not had a very profitable return this year; but I had a number of sheep, and foresaw what was coming. I said to some of my neighbours, “We shall have a great deal of rot this year;” and I thought I would attempt, if I could, so far as my own sheep were concerned, to save them. What did I do? The sheep were on wet meadows up to the fetlock joints nearly every day, and nobody could avoid it. But at Midsummer I began to feed the lambs and sheep with corn and nitrogenized food, giving them with every meal a small quantity of salt. I continued that plan during the autumn, and I have the satisfaction of saying that I do not believe at the present time I have one of those lambs affected by rot. I kept killing them week by week to watch their progress. And here I may incidentally observe that long-continued wet weather is very prejudicial to the sheep in another way. I refer now to the water-rot. What was the state of the liver of these animals at Midsummer? There were no flukes or anything of that kind, but the liver was streaked with white here and there, and generally pallid. That was for the want of nitrogenized matter. The bile-cells were blanched; the liver had become structurally diseased, and it was a good nidus for these entozoa to inhabit. Not only, however, did the treatment prevent the entozoa, but it brought about a healthy state of liver, for in the course of a month or two I found that that organ resumed its natural colour and consistence. I again say, that if we commence at Midsummer, and continue the treatment through the dangerous period of a wet season, we may do a great deal in the prevention of the disease. And I may go further, and say that even on farms where we have what are called rotten pastures, on which sheep are placed, they might be preserved to a very considerable extent simply by giving nitrogenized food and salt, to destroy these creatures within the stomach, and prevent their final change, alternating with the salt a tonic, invigorating agent, such as sulphate of iron. I do not depend on the salt alone; far from it; but it is a valuable agent, and its value depends more upon putting these things into salt water, as it were, in the stomach, than anything else. This is the course I recommend. You have to look to the condition of the liver in a wet season; you have to look to the necessity of laying the foundation for a good quality of blood, by giving these animals nitrogenized food, and throwing sulphate of iron into the organism. Every practical pathologist, human or veterinary, knows very well that if you have an anæmiated or bloodless state of the system—if there is a deficiency of the red cells, upon which the invigorating properties of the blood depend, those cells will rapidly multiply, and the blood regain its proper colour

by the use of iron. This is the reason why sulphate of iron should be employed. It should be given in fine powder, and in doses of about half a drachm a day; not, however, that a larger quantity would be prejudicial. The sheep should be divided into small lots; and if you have about a score feeding in one trough there should be ten drachms of sulphate of iron mixed with the food for the day; and then, if one should get a little more, and another not quite so much, it will be of very little importance. These are matters of detail which of course every individual farmer must carry out for himself; but if he will adopt these leading principles that I have attempted to lay down this morning, in a very imperfect manner, he will save a considerable number of his sheep from falling a sacrifice to the affection which is commonly designated "rot."

No apology is offered for occupying so many pages with valuable information on the sheep rot—a subject which ought to be borne in mind by the farmer in the month of June. We have, with many others, to thank Professor Simonds and the Agricultural Society of England for placing it at our disposal.

It only needs to be added, that the first preventive of all consists in an alteration of the condition of the land. Sheep do not rot in dry pastures; and land-drainage is the great remedy on which the farmer should depend for his safety.

The Sheepfold is carried out industriously all through the month of June on light soils in the southern counties. The flock fed upon the downs may be folded once or twice to a place during night, at first on the fallows intended for turnips, and afterwards on grass and clover, rape, &c., in fields to be broken up in autumn for wheat.

Hogs may be feeding on clover either in the field, or, what is better, in yards, where the cut clover, lucerne, chicory, &c., may be brought to them, and where, if supplied very amply with litter, a large store of valuable manure will accumulate during the summer months. The most profitable litters of the whole year are those of the sows which pig in June, though the time is both too early and too late for their next litter to fall at a good time.

Sundry Work.—Memoranda may be added here of things which ought to be done at every suitable opportunity in the month of June. The last of the threshing previous to next harvest will probably be completed this month. Preparation may be made by clearing out both yards and granaries, and buildings generally, for the reception of the new crop, storing away a supply of straw for thatch; and the formation of rick bottoms and mending of rick staddles, where necessary, should be done.—Roads and fences should be looked to, cleaned, and mended.—Ponds may be emptied and rivers cleaned: a lot of useful stuff for compost heaps may thus be obtained. It should be piled up in a heap and suffered to drain dry before being turned over with the spade to the weather.

JULY.

The ordinary weather of July may be learned by an examination of our usual monthly meteorological table on the following page.

The work of July is generally confined to haymaking and preparation for harvest work. I propose to refer, however, to several other topics here, either of local or general interest, which may be arranged as follows:—(1) *Horse versus ox teams*; (2) *green manuring*; (3) *warping*; (4) *digging chalk and marl*; (5) *preparation for harvest work*; (6) *crop cultivation*; (7) *the live stock of the farm*; (8) *the leisure of the farmer*.

I.—OXEN VERSUS HORSES.

The economy of employing draught oxen in place of a certain proportion of the horses generally worked on the farm has long been advocated, and is in accordance with general practice over still a very considerable extent of arable land in this country. The following statement on the subject is from the pen of Mr. Ellman, of Landport, Sussex. He asks “whether it is economical to work oxen, not to supersede horses, but as an auxiliary in farming operations, calculating one horse to two oxen, and the following is his calculation:—

	£	s.	d.
“ Value of a cart colt, at 2½ years old . . .	31	10	0
At 3½ years it would be worth . . .	36	15	0
At 4½ years it would be worth . . .	42	0	0
Value of a pair of steers, 2½ years old . . .	29	4	0
At 3½ years old	35	0	0
At 4½ years old	40	0	0
At 6 years old, when turned off to fatten . . .	48	0	0

“I calculate the worth of the horse and oxen if sold at the time they would be most valuable for working. The keep of one horse I consider to cost as much as that of the two oxen, and the work performed equal. I say nothing as to oxen working in collars and harness like horses. It is not the custom so to work them in this county, and I consider it a great saving to work them in single or double yokes. We in Sussex work them in a double yoke, which with bows and irons costs about 20s. This lasts for many years, and the only cost is now and then a new bow, costing 1s. I know the double yoke looks unwieldy, but experiments have been made,

THE WEATHER OF JULY.

LOCALITY.	AUTHORITY.	Lowest		Highest	Lowest		Greatest	Highest	Average		Smallest		Average		Smallest		No. of
		Mean	mean		tempe- rature.	tempe- rature.	heat.		amount	of rain.	amount	of rain.	amount	of rain.	number	of rainy	
		tempe- rature.	mean	tempe- rature.	heat.	heat.	min- imum	max- imum	inches.	inches.	inches.	inches.	inches.	inches.	of number	of days.	years'
Guernsey	Dr. Hoskins, F.R.S.	60.4	56.2	65.1	83.5	68.0	56.0	50.0	2.2	1.0	4.3	10	5	14	12	16	12
Helston	Mr. M. P. Moyle ..	64.1	61.6	70.2	90.0	74.0	52.0	43.0	2.5	0.5	4.2	12	6	20	16	7	16
Exeter	Mr. W. H. Ellis	62.2	59.2	66.6	89.7	78.9	53.6	43.5	2.1	1.0	3.5	15	8	20	19	22	7
Ventnor, I. of Wight	Dr. Martin ..	61.9	67.5	67.5	86.0	70.0	55.0	46.0	1.9	0.4	3.6	11	5	19	20	22	22
Worthing, Sussex	Dr. Barker	61.1	57.7	67.0	82.5	71.0	53.0	42.6	1.6	0.4	2.9	10	3	18	9	8	9
Clifton, near Bristol	Mr. W. Burder, FRAS	60.3	57.8	66.0	86.6	76.1	50.1	41.3	2.8	1.7	4.8	15	12	19	8	8	8
London Royal	{ The Astronomer																
Observatory	{ Royal, F.R.S.																
Bedford	Dr. Barker, F.R.A.S.	62.6	58.6	68.6	94.0	80.0	49.0	39.0	2.3	0.9	3.3	13	7	17	10	10	10
Lampeter, near	Rev. Prof. Mat-	59.2	57.2	63.9	89.0	76.5	44.0	38.8	2.7	1.8	3.9	11	7	17	6	6	6
Cardigan	thews, M.A.																
Norwich	Mr. W. Brooke, FRAS	61.9	57.3	66.8	86.0	75.0	54.0	39.0	2.7	0.5	6.5	11	3	19	14	14	14
Highfield-House	Mr. E. J. Lowe, }																
Observatory ..	{ F.R.A.S.																
Oxford Observatory	Rev. R. Main, F.R.S.	61.2	57.3	65.7	88.3	73.5	51.0	42.0	3.0	0.6	5.1	12	7	22	34	34	34
Grantham	Mr. J. Jeans, F.R.A.S.	60.1	57.7	65.8	91.3	73.2	50.0	38.4	2.9	1.5	4.7	13	7	17	10	10	10
Hawarden, Chester	Dr. Moffat, F.R.A.S.	59.3	56.3	63.0	83.0	71.0	58.1	44.0	3.1	1.3	6.3	14	9	25	11	11	11
Manchester	Mr. G. Vernon FRAS	60.5	57.6	67.9	89.5	74.0	47.0	37.3	2.9	1.3	4.5	16	10	22	12	12	12
Leeds	Mr. H. Denny	61.5	58.0	68.0	95.0	78.0	49.0	38.0	2.2	1.1	3.6	15	12	21	10	10	10
York	Mr. Ford	59.7	55.4	65.0	87.0	73.0	49.0	40.0	2.6	0.8	4.1	12	6	18	20	20	20
Scarborough	Mr. B. Cooke	57.4	54.1	60.2	77.4	69.7	53.5	42.3	2.3	1.0	3.1	9	5	15	6	6	6
Ile of Man	Mr. J. Burman, FRAS	56.9	54.8	60.2	77.4	70.7	45.6	39.0	2.0	1.0	3.5	11	7	14	7	7	7
Durham Observry	Mr. A. Marth, FRAS	58.0	54.7	62.5	84.2	66.4	48.4	39.3	2.5	1.1	4.1	11	5	18	13	13	13
North Shields	Mr. R. Spencer	58.3	55.0	62.3	81.4	68.0	50.3	41.8	3.4	0.8	6.7	18	8	22	16	16	16
Silloth	Rv. F. Redford, FRAS	58.5	57.4	60.1	83.1	74.1	42.1	39.8	3.1	2.3	4.6	13	11	17	3	3	3

* Observations at Highfield House on temperature extend over fifty years, and at the Royal Observatory over ninety years.

and it has been proved that a pair of oxen in a double yoke can draw a greater weight than in any other way. My late father used to breed his own oxen, and every year bring them into work. The team consisted of twenty-four. He considered that oxen should be kept as auxiliaries. They were never worked so as to be low in flesh, and, of course, their growth was not checked. By keeping them always in a good state, if anything happened to them they were put to fatten, and soon got fat. He worked at different times Sussex, Herefords, and Devons. Between the Sussex and Herefords there was not much difference, but the Devons were certainly more active. On the farms on the Southdowns it is very much the fashion now to work the Welsh cattle. They are very hardy, excellent workers, with good feet, a great desideratum amongst flints, and will live on very scanty food. It must never be forgotten, that if anything happens to render a horse unfit for work he is almost valueless; whereas if an ox is lame he can be converted to a good purpose, and is soon made of value."

It is, however, only fair to add, in reference to the proofs of greater economy which every now and then re-appear in favour of ox labour, that the practice has nevertheless long been dying out, and the districts have been narrowing in which it still prevails.

The fact is, that farm operations are so linked together that the establishment of any sluggish element drags the whole affair. Oxen, notwithstanding their fitness for field work, and their economical performance of it under efficient management, are not so active as horses under equally good management, and the quicker agency has been gaining ground more rapidly, the more that time is valued and turned to account in ordinary farm management. Where a perfect organization of labour prevails, and lads and men are made to feel the influence of activity and energy in their master, the maintenance of such a sluggish pace as is natural to the ox is impossible. The horse may become one half his former value while the ox has been increasing in its market value, the former may have consumed twice the money's worth of food—but his work has been so much more valuable, both in itself and in its influence on the manual labour of the farm as well, that however possibly he may be superseded by the steam-engine, he is not at all likely to be superseded in the field by the ox.

In fact, every year fewer acres are ploughed, fewer loads are carried by ox-labour, notwithstanding that every now and then an indignant remonstrance tries in vain to waken our farmers to the advantages they are most unaccountably allowing to slip from between their fingers. The truth is that, after all, farmers understand their business and their interests sufficiently well to make it altogether improbable that the gradual decadence of a once almost universal practice is the result either of ignorance or supineness.

Neatness of arrangement and fitness of design in farm buildings are with justice urged, on the ground of their influence on the habits and feelings, and therefore the efficiency of farm-labourers; but how much more powerful must a consideration of the kind before us be! I have seen a man, two boys, and four pair of oxen "dragging" a fallow field at the rate of one and a half mile an hour; it might admit of discussion whether the land was receiving more harm or good from the operation, but there could be no discussion as to its influence on the labourers who were superintending it; and I believe that the true secret of the rise of the horse upon the ruins of the ox as a beast of labour, in spite of speculative estimates and remonstrances to the contrary, is to be found in the mischievous influence of the latter on the whole style and character of farm labour.*

* The following note on this subject may be added, although it gives an estimate of not very recent date:—

In the fifth volume of the *Agricultural Society's Journal*, Mr. Cowie's experience is described. He states that the ordinary daily allowance to horses during winter is sixteen lbs. of oats and as much oat straw as he chooses to eat. His oxen get as many turnips as they can eat, and they are fed four times a day, at 5 A.M., 11 A.M., 6 P.M., and 8½ P.M.; the mid-day meal of turnips is sliced. Both horses and oxen graze during summer. Mr. Cowie worked them in pair or teams ten hours a day as steadily all the year round, except in frost, as the horses, and they kept in good condition. A pair of farm horses, four years old, suitable for all kinds of work, could then be bought for 56*l*. Their gear or harness and its repairs would cost 25*s*. a year. Should no accident occur a horse will last twelve years, at the end of which time he is worth about 6*l*. Including the difference between the original purchase and the ultimate selling price, together with interest, the sum of 3*l*. 10*s*. is the cost annually on each horse. There should be added to this 30*s*. to cover accidents.

A pair of oxen, four years old, then cost 26*l*. "The last pair," says Mr. Cowie, "which I bought cost 24*l*.; they have been worked regularly four years, and I am now feeding them for slaughter. I expect to get about 30*l*. for them. They work one day a week at the threshing machine, which does not seem to retard their feeding. I would therefore calculate that no loss will be sustained on oxen from the time of their being bought and sold." The cost of gear, including keeping in repair, is 10*s*. annually. The account of the different items stands thus:—

<i>Expenditure, &c., on a working horse yearly.</i>		£	s.	d.
To 10½ quarters of oats at 18 <i>s</i> .	.	9	9	0
To deterioration in value, interest on outlay, losses by accident and death	.	5	0	0
To shoeing and medical attendance	.	1	3	0
To furnishing and repairing gear	.	1	5	0
Total cost, excluding summer grazing	.	£16	17	0
<i>Expenditure, &c., on a working ox yearly.</i>		£	s.	d.
To 23½ tons of turnips at 10 <i>s</i> . per ton	.	11	15	0
To furnishing and repairing gear	.	0	10	0
To loss on work during frost	.	4	10	0
To interest on purchase price	.	0	15	0
Total cost, excluding summer grazing	.	£17	10	0

"In the above table," says Mr. Cowie, "I have calculated the oats given to the

II.—GREEN MANURING.

This is a sort of manuring which has many advocates and some enemies, resulting probably from their having drawn conclusions from trials on different soils and under different circumstances. The probability of success is greater when the vegetable is ploughed in at Midsummer than at Michaelmas, as the warmth of season must considerably aid the rotting process in the soil. Whatever the plant may be, whether rye, tares, or very early sown buck-wheat, it should be ploughed down with a skim-coulter plough, dragging also a short, heavy chain from the upper part of the coulter in the furrow. This levels and buries all surface growth, and is the only means of turning it so completely in as to be quite concealed from the eye.

If done earlier in the season it may precede a crop of turnips or of rape, though it cannot be depended on as a sufficient preparation of the land for either. Superphosphate of lime must be also added to ensure a crop, and except in wet seasons the burial of so much fibrous material, although it be of a succulent nature, will tend to dry the land and unfit it for the growth of a crop. If, however, it be buried now, or even later, it will thoroughly rot in the soil long before the seed time of wheat, and for that crop the operation may be a useful preparation. The practice of green manuring along with the use of artificial manures, as grain and superphosphate, is especially useful on light soils, where not only grain, but a large proportion of the green crops of the farm, as potatoes and mangold wurzels, are sold off the land. Some method of supplying vegetable matter as well as mineral manures to the soil seems then to be required, and the practice of green manuring meets the case

III.—WARPING.

The following description of this process occurs in the original edition of this work :—

This singular operation begins in June. It is practised only in Lincolnshire and Yorkshire.

The water of the tides that come up the Trent, Ouse, and other rivers which empty themselves into the great estuary of the

horses at the market price; but the cleanings and inferior grain which cannot be otherwise disposed of constitute a considerable portion of their food, and thus the cost on this item can be reduced; otherwise the figures above so nearly correspond, that it rests with the partiality of parties whether they shall employ horses or oxen, or partly both. For my own part, after duly considering the matter and after the experience of a number of years, I should give the preference to employing horses exclusively."

Humber, is muddy to an excess ; insomuch that in summer, if a cylindrical glass, twelve or fifteen inches long, be filled with it, it will presently deposit an inch, and sometimes more, of what is called warp. Where it comes from is a dispute ; the Humber, at its mouth, is clear water ; and no floods in the countries washed by the warp rivers bring it, but, on the contrary, do much mischief by spoiling the warp. In the very driest seasons and longest droughts, it is best and most plentiful. The improvement is perfectly simple, and consists in nothing more than letting in the tide at high-water to deposit the warp, and permitting it to run off again as the tide falls ; this is the aim and effect. But to render it efficacious, the water must be at command, to keep it out and let it in at pleasure ; so that there must not only be a cut or canal made to join the river, but a sluice at the mouth, to open or shut, as wanted ; and that the water may be of a proper depth on the land to be warped, and also prevented flowing over contiguous lands, whether cultivated or not, banks are raised around the fields to be warped, from three or four to six or seven feet high, according to circumstances. Thus, if the tract be large, the canal which takes the water, and which, as an irrigation, might be called the grand *carrier*, may be made several miles long ; it has been tried as far as four, so as to warp the lands on each side the whole way, and lateral cuts made in any direction for the same purpose : observing, however, that the effect lessens as you recede from the river ; that is, it demands longer time to deposit warp enough.

But the effect is very different from that of irrigation ; for it is not the water that works the effect, but the mud, so that in floods the business ceases, as also in winter : and it is not to manure the soil, but to create it. What the land may be which is intended to be warped, is not of any consequence : a bog, clay, sand, peat, or a barn floor ; all one : for the warp raises it in one summer from six to sixteen inches thick ; and in hollows or low places, two, three, or four feet, so as to leave the whole piece level. Thus a soil of any depth you please is formed, which consists of mud of a vast fertility, though containing not *much* besides sand ; but a sand unique. But from examining in the fields much warp, I am clear there must be clay in some, from its caking in small clods, and from its cleansing cloth of grease, almost like fuller's earth. A considerable warp farmer told me, that the stiffer warp was the best ; but in general it has the appearance of sand. So much, in general, as to the effect : the culture, crops, &c. are circumstances that will best appear, with others, in the following notes, taken on the spot.

Mr. Webster, of Baukside, has made so great an improvement by warping, that it merits particular attention. His farm of 212 acres is all warped ; and to show the immense importance of the

improvement, it would be necessary only to mention, that he gave 11*l.* an acre for the land, and would not now take 70*l.* an acre; he thinks it worth 80*l.* and some even 100*l.*; not that it would sell so high at present; yet his whole expense of sluices, cuts, banks, &c. did not exceed 2500*l.* or 12*l.* per acre; from which, however, to continue the account, 1500*l.* may be deducted, as a neighbour below him offers 5*l.* an acre for the use of his sluice and main cut, to warp 300 acres, which will reduce Mr. Webster's expense to 1000*l.*, or about 5*l.* an acre. Take it, however, at the highest, 12*l.*, and add 11*l.* the purchase, together, 23*l.* an acre; if he can sell at 70*l.* it is 59*l.* per acre profit. This is prodigious, and sufficient to prove that warping exceeds all other improvements. He has warped to various depths, eighteen inches, two feet, &c. He has some that, before warping, was moor-land, worth only 1*s.* 6*d.* per acre, now as good as the best. Some of it would let at 5*l.* for flax or potatoes; and the whole at 50*s.* He has twenty acres that he warped three feet deep, between the beginning of June and the end of September, and eighteen acres, part of which is three feet and a half deep. He has applied it on stubbles in autumn, by way of manuring; for it should be noted, as a vast advantage in this species of improvement, that it is renewable at any time: were it possible to wear out by cropping, or ill-management, a few tides will at any time restore it. As to the crops he has had, they have been very great indeed; of potatoes from 80 to 130 tubs of thirty-six gallons. Twenty acres warped in 1794, could not be ploughed for oats in 1795, he therefore sowed the oats on the fresh warp, and scuffled in the seed by men drawing a scuffer; eight to draw, and one to hold; the whole crop was very great: but on three acres of it measured separately, they amounted to fourteen quarters one sack per acre. I little thought of finding exactly the husbandry of the Nile in England. I had before heard of clover seed being sown in this manner on fresh warp, and succeeding greatly.

He warped twelve acres of wheat-stubble, and sowed oats in April, which produced twelve quarters an acre. Then of wheat, thirty-six bushels an acre.

Six acres of beans produced thirty loads per acre, or ninety bushels: one acre, measured to decide a wager, yielded ninety-nine bushels. Has had 144 pods from one bean on four stalks; and Tartarian oats seven feet high. One piece, warped in 1793, produced oats in 1794, six quarters an acre: white clover and hay seeds were sown with them, mown twice the first year: the first cutting yielded three tons of hay an acre; the second one ton; and after that an immense eddish. Warp, Mr. Webster observes, brings weeds never seen here before, particularly mustard, cresses, and wild celery, with plenty of docks and thistles.

A sluice for warping, five feet high, and seven wide, will do for fifty acres per annum; and if the land lie near the river, for seventy. Costs from 400*l.* to 500*l.*

Mr. Nicolson, at Rawcliff, takes the levels first; builds a sluice; if a quarter of a mile or half a mile, sixty acres may be done the first year; the drier the season the better: the clough, or sluice, 400*l.*, eight feet wide and five or six feet high: a drain fourteen feet at bottom, and as much more at top, 30*s.* to 40*s.* per twenty-eight yards: banks four to eight feet high, and expense 7*s.* to 20*s.* per twenty-eight yards. Begin at Lady-day, till Martinmas; but all depends on season. The depth will depend on circumstances: if a landlord warp, it should be deep at once; if a tenant, shallow; and repeat it. As good corn will grow at six inches as six feet; and three inches of warp will bring great crops. The stiffer the warp the better. Some seasons sow corn the year after.

Mr. Wilson's idea of warping is very just: to exhaust the low lands in favour of the hills; then to warp six inches deep, to exhaust that to make the hills; then to warp again; and by thus doing to keep the warp land in the highest order, and at the same time work a great improvement to all the higher grounds.

The following is a note by a Commissioner employed in Warping:—"Warp leaves one-eighth of an inch every tide, on an average; and these layers do not mix in an uniform mass, but remain in leaves distinct.

"If there be only one sluice, then only every other tide can be used, as the water must run perfectly off, that the surface may incrust; and if the canal be not empty, the tide has not the effect. At Althorpe, Mr. Bower has warped to the depth of eighteen inches in a summer.

"Ten quarters an acre of oats, on raking in the seed on warp; the more salt in it the better, but one fallow in that case necessary, to lessen the effect, or it hurts vegetation."

A very great object in this husbandry of warping, is the application of it in other districts. They have much warp on all the coasts from Wisbeach to Boston, &c., and though a long succession of ages has formed a large tract of warp country, called there *silt*, yet no attempts that I have heard of have been made to warp artificially there.*

IV.—CHALK, MARL, &c.

Any leisure time in summer, as in June or July, may be employed in digging marl and chalk, and carting it near where, before winter, it is to be spread broadcast on the land.

* Consult also Mr. Creyke's paper on the subject in the fifth volume of the *English Agricultural Society's Journal*.

In tracts of waste lands, or sheep-walks and warrens let at six or seven shillings an acre, marl being discovered, and rendering such land capable of yielding noble crops of turnips, clover, and all sorts of grain and pulse, the uncommon effect, and the amazing advantages made by it, have proved to be so striking, that its use has spread fast. But, on the contrary, when marl is found under richer soils, enclosed countries (for instance, of fifteen to thirty shillings an acre), the case is different: it will not make such an improvement as on the poorer lands: and, as great fortunes are not suddenly made by the use of it, the farmers in some districts will not be persuaded to use it with any spirit, possibly not at all. In that case, landlords should set the example, and show that the work will answer well.

Marl is of various sorts, and lies in various strata; in some places it is a soft, fat, soapy substance; in others it is hard as chalk, which are called stone marls; sometimes you find it white, sometimes grey, also blue, yellow, and a dark brown; and in some countries you have shell-marl. The depths at which it lies are various: sometimes only three feet from the surface, at others ten or twelve; and in some places so deep that it will not answer to get it at all. The strata are also of different thickness, from two feet to twelve feet deep.

The best way of conveying it on to the land, if it does not lie very deep, is to open a sloping mouth, sinking the pit gradually, wide enough for a cart to drive in and out: and, when you come to the marl, to work it away circularly, and to keep the pit ten or fifteen feet deep, by which means the expense of filling the cart will be much lessened.

When marl is not to be had, clay, in many places, is to be found at a moderate depth. This manure, though not possessed of all the properties by which marl is known, yet works wonderful improvements on many soils. In some light lands it has been preferred by many very good farmers to indifferent sorts of marl, and this preference has been the result of attentive experience.

But the great point concerning clay is not so much the comparison with marl, as the use of it where no marl is to be had. On all light sandy soils it should be used with a confidence of success; for the precedents of its good effects are so numerous, that we cannot have a doubt of its excellence. About sixty or seventy loads an acre, at the same expense as of marl, will work an improvement great enough to show how much mistaken those men are who think nothing but the finest marls worthy of attention.

Chalk is a manure common in many parts of the kingdom, and this month is a very proper season for digging it. A distinction is here to be made between hard and soapy chalks. The latter ought always to be ranked among the marls, for such they really are; but

the former are properly chalk, and of excellent use on many soils; they work a great improvement on light sands and light loams; they have in many places been used with great success on gravels; and on clayey loams and clays they do extremely well, mellowing them greatly, and bringing them into much better order for ploughing, and much earlier in the spring, which, on such soils, is always a matter of consequence. The expenses of this improvement are the same as the marl or clay, being sometimes dug and thrown directly into carts, and at others drawn up in buckets through shafts. These variations are not of such importance as to exclude the propriety of the improvement, even in the most expensive countries.

I add the following particulars of the cost of the operation from Mr. Raynbird's paper on "Measure Work," in the eighth volume of the *English Agricultural Society's Journal*.

"By the process of marling I believe is to be understood what we in Suffolk denominate claying, and perhaps improperly so, for there is very little clay applied to the land that does not contain a large proportion of lime; and the general test as to the good quality of clay is the presence of small particles of chalk, or chalk-stones as they are here termed. Notwithstanding this, I have used the term claying, because it is so called in this county, and in order that I may not be misunderstood: but it must not be taken for granted that I mean real clay, but a mixture of clay and chalk, which ought properly to be termed marl.

"The application of marl or clay may be said to be general both on heavy and light land. On heavy it is used on freshly broken-up pasture land, and mixed with farm-yard manure in the formation of compost heaps. On light soils its application is of course more extended, as it is here that the great benefits are derived by the improvement in the mechanical texture of the soil.

"The scouring of ditches on the heavy soil is carted to form bottoms for the farm-yard manure, with which it is mixed by turning, &c.

"On freshly broken-up land, clay and other soil is carted on to the amount of from forty to fifty cubic yards per acre. The benefit derived from this is the better quality of the grain, and regularity of the crop. New land, whether it is naturally of an adhesive and retentive nature, or dry and sandy, or light and loose peaty soil, is found to produce a patchy crop of a bad quality of grain, which is corrected in a great measure by the application of marly clay. The excess of organic matter in the heavy soil gives it a looseness of texture which the clay corrects: the dry and loose texture of the sand is rendered more adhesive and retentive of moisture, and the peat is benefited by consolidation, and the supply of inorganic matter.

"In first beginning to marl or clay a field, if no pits have been begun beforehand, it is usual to ascertain where the best material can be most conveniently raised for carting. This is done by digging down to ascertain the subsoil, and frequently the marly clay is found within a foot of the surface. The soil is now dug and filled into carts; the digging proceeds in a sloping direction downwards, so as to form a mouth to the pit of a gradual descent, for if very steep the horses are liable to be strained in drawing the loaded carts from the pit. As soon as a sufficient depth is obtained the plan of operations is altered; for instead of picking and digging they now proceed to make what are termed 'falls,' in a manner that is well known to all excavators: this is done by picking or undermining at the bottom for a sufficient distance along the side, and at the extremities of the undermined part, a perpendicular crevice is picked out from the top to the bottom. This having been completed, clay wedges shod with iron are driven in at top with a heavy mallet or beetle, and this being continued for a short time the clay splits down perpendicularly. In this manner as much soil is 'raised' as will be filled into carts by three men in a day's work.

"The labour of filling clay is generally paid for by the cubic yard or load: for filling and spreading from $2\frac{1}{2}$ *l.* to 3 *l.* per yard is paid. The work is sometimes done by men who contract at so much a yard (measuring the pit when the work is done) for filling, spreading, and carting, finding carts and horses: the price is about 7 *l.* per yard if carted one furlong, 1 *l.* being added for every additional furlong, but this has been already described in the report on Measure Work. Ten yards a day is reckoned a fair day's work for one man."

It is only necessary to add that in the fen districts of Lincolnshire much claying, where the peaty soil is deep, is done by digging deep trenches, at intervals of eleven yards or more, and spreading the contents over the surface, afterwards filling up these trenches with the peaty soil. This, however, is done before winter. The Midsummer work consists merely in digging and getting ready for autumnal use a store of the clay, marl, or chalk, that is to be applied.

V.—HARVEST WORK.

Although the harvest work of July rarely includes more than haymaking, saving grass seeds, and cutting pease and winter beans, to all of which reference will immediately be made, yet it is well before the usual harvest time for wheat to call attention to the proper time at which wheat should be cut.

It would certainly at first appear that the farmer cannot be wrong in allowing his grain-crops to attain maturity—to become

fully ripe; ancient practice, so far as it goes, would certainly justify him in doing so. And if by the period of maturity the time be meant when a plant has acquired its greatest value as an article of food, certainly this stage in the growth of every kind of crop ought to be attained before it is harvested; it is, however, by no means certain that maturity in this sense is not attained by our corn crops at an early period in the process of ripening. Indeed it may safely be asserted that grain has passed the period of perfection, and has begun to lose its value before it has become dead ripe. In support of this the testimony of all nature may be urged that strength and vigour progress with growth only up to a certain period.

General reasoning, however, of this kind could never have been so influential with any farmer as to induce him to alter so important and time-sanctioned a practice as that of leaving grain to ripen thoroughly. And, practically speaking, the question remained undisturbed till Mr. J. Hannam, of Kirk-Deighton, near Wetherby, Yorkshire, now (1861) Secretary of the Yorkshire Agricultural Society, in the *Quarterly Journal of Agriculture* for June, 1841, boldly asserted that the practice of allowing wheat to become fully ripe was an injurious one. This assertion was based on the details of a careful and elaborate experiment made during the previous year, 1840. In 1841, Mr. Hannam continued his investigations on a still more extensive scale, and the results thoroughly corroborated his former conclusions. In September, 1842, the details were published in the *Quarterly Journal of Agriculture*, and the question was discussed at length, the conclusion being that *the best period for cutting wheat is when it is raw, i.e., from ten to fourteen days before it becomes thoroughly ripe.*

This decision has been since confirmed by the testimony of both science and practice. Professor Johnston in his *Lectures* quotes Mr. H.'s results, and confirms them by argument. He also states in his *Elements of Agricultural Chemistry*, as "the result of theory and experience," that "about a fortnight before full ripening is the proper time of cutting corn, as the skin is then thinner, the grain fuller, the bushel heavier, and the yield of flour greater." Mr. Stephens, in his excellent *Book of the Farm*, corroborates Mr. H.'s position. Indeed both the English and American agricultural press have supplied numberless cases in support of his facts and arguments.

Mr. Hannam's first experiment was executed in 1840. Three samples were cut, viz. respectively as follows:—

- | | | | |
|--------|---------------|-------------|---------------|
| No. 1. | Green, cut on | | Aug. 4, 1840. |
| 2. | Raw | „ „ | Aug. 18. |
| 3. | Ripe | „ „ | Sept. 1. |

These were threshed and carried to market, when the following prices were put upon them:—

No. 1.		61s. per quarter.
2.		64s. „
3.		62s. „

In 1841, a more extensive experiment was instituted; five samples of half-a-rood each were cut, viz.:—

No. 1.	Very green	Aug. 12.
2.	Green	Aug. 19.
3.	Raw	Aug. 26.
4.	Raw	Aug. 30.
5.	Ripe	Sept. 9.

These samples were threshed, and the samples were as follow:— No. 5 (ripe) was “bold, but coarse;” Nos. 1 and 2 (green), “fine in the skin, but small;” and Nos. 3 and 4, “equal in boldness of grain to No. 5, and superior in clearness of skin,” being “unexceptionable as a sample.” This shrinking or drying of Nos. 1 and 2 proved that it was in those cases taken too early. The whole of the samples were shown at the annual show of the Wetherby Agricultural Society, Sept. 22, 1841, when the superiority of the raw-cut grain was confirmed by the judges, who awarded to it “an extra premium, with a high commendation of the sample No. 3, cut a fortnight before ripe.”

Having in one trial ascertained the value of the samples by market, and afterwards by the opinion of a public meeting, in order to leave no loophole for doubt, Mr. Hannam determined to test their qualities at the mill. The gross quantity of each was ground and dressed by Mr. John Hardcastle, of Wetherby; and from the results the annexed tables are compiled:—

No.	Grain.		Flour.	Pollard.	Bran.	Waste.	Cut.
	Quantity.	Weight.					
3.	bush.	st. lb.	st. lb.	st. lb.	st. lb.	lbs.	Raw.
4.	$3\frac{1}{2}$	15 10	12 6	0 12	2 1	5	Do.
5.	$3\frac{1}{2}$	16 6	12 3	1 3	2 5	9	Ripe.
	$3\frac{1}{2}$	14 13	10 11	1 9	2 5	2	

Weight per Bushel of

No.	Grain.	Flour.	Pollard.	Bran.
	lbs.	lbs.	lbs.	lbs.
3.	62 $\frac{2}{7}$	49 $\frac{5}{7}$	3 $\frac{3}{7}$	8 $\frac{2}{7}$
4.	62 $\frac{2}{5}$	46 $\frac{2}{5}$	4 $\frac{2}{5}$	8 $\frac{2}{5}$
5.	59 $\frac{2}{7}$	43 $\frac{2}{7}$	6 $\frac{2}{7}$	9 $\frac{2}{7}$

Early Cutting Wheat.

Weight per cent. of

No.	Grain.	Flour.	Pollard.	Bran.
	lbs.	lbs.	lbs.	lbs.
3.	100	$80\frac{4}{8}$	$52\frac{5}{8}$	$13\frac{1}{8}$
4.	100	$77\frac{8}{8}$	$71\frac{5}{8}$	$14\frac{2}{8}$
5.	100	$72\frac{9}{8}$	$11\frac{2}{8}$	$15\frac{3}{8}$

"From this we see," says Mr. Hannam, "that the bushel of No. 3 gives more flour than the bushel of No. 5 by $6\frac{1}{2}$ lbs., showing a gain of $15\frac{1}{2}$ per cent. in weight of flour upon equal *measures* of grain, and of nearly 8 per cent. of flour in favour of No. 3 upon equal *weights* of wheat."

The theory upon which Mr. Hannam explains these results is, that as the sugar in the green plant becomes changed into the starch of the wheat, so if permitted to remain till fully ripe another change will take place, the starch becoming gradually converted into *woody fibre*; for it is a well-known chemical fact, that sugar, starch, and fibre, are composed of the same constituent elements, differing only in the quantity of water combined with their carbon.

This gradual change to woody fibre takes place in many vegetables as they ripen, and it is by taking this into account that we can explain the curious fact shown in the tables that the ripe wheat contains 50 *per cent. more* "pollard," or "sharps,"—than the "raw cut grain." Hence it is no wonder that there should be less flour in the grain of the ripe wheat.

Mr. Hannam also claims a "better quality of flour" for the raw cut grain, and quotes the analysis of Professor Johnston, to whom samples were sent, from which it appears that the

Raw wheat contained 9.9 per cent of gluten.

Ripe do. do. 9.6 „ „

The other advantages claimed for cutting early, are a better quality and quantity of straw, a better chance of securing the crop, &c.

Thus Professor Johnston says:—

"The *rawer* the crop is cut, the heavier and the more nourishing the straw. Within three weeks of being fully ripe, the straw begins to diminish in weight, and the longer it remains uncut after that time, the lighter it becomes and the less nourishing. On the other hand, the ear, which is sweet and milky a month before it is ripe, gradually consolidates, the sugar changing into starch, and the milk thickening into the gluten and albumen of the flour. As soon as this change is nearly completed, or about a fortnight before ripening, the grain contains the largest proportion of starch and gluten; if reaped at this time, the bushel will be heavier, and will

yield the largest quantity of fine flour and the least bran. At this period the grain has a thin skin, and hence the small quantity of bran. But if the crop be still left uncut, the next natural step in the ripening process is to cover the grain with a better protection—a thicker skin. A portion of the starch of the grain is changed into woody fibre—precisely as in the ripening of hay, of the soft shoots of the dog rose, and of the roots of the common radish. By this change, therefore, the quantity of starch is lessened, and the weight of husk increased; hence the diminished yield of flour, and the increased produce of bran. Theory and experience, therefore, indicate about a fortnight before full ripening as the most proper time for cutting corn. The skin is then thinner, the grain fuller, the bushel heavier, the yield of flour greater, the quantity of bran less; while, at the same time, the straw is heavier, and contains more soluble matter than when it is left uncut until it is considered to be fully ripe.”

I add one more testimony on this subject from Mr. W. H. Fletcher, of Pentrich Mills, near Derby, which very strikingly corroborates Mr. Hannam’s results. He says—“Nevertheless, I am thoroughly convinced that unless experiments continue to be made and reported annually, about the time of harvest, by individuals whose veracity they have no reason to doubt, and whom they know personally, farmers in general will continue to let their wheat become unduly ripe before they cut it, and thus suffer loss themselves; and through so doing, the country in general sustains no small loss. By cutting wheat fourteen days before it is dead ripe, they have a better opportunity of carrying it in good condition, and incur no risk of any shedding; they have, I am of opinion, quite as much in measure, brighter colour, greater weight of straw and much better quality, for food, for litter, and for bonnet-manufacture; and as the straw is much more nutritious and digestible, it follows, as a matter of course, that the manure made therefrom is of greater value than that made from dead-ripe straw. I can assure them that wheat cut as above recommended yields more and better flour. The flour was made into bread by a baker in whom I have the most entire confidence; and the bread made from the wheat first cut was not only more in quantity, but better in quality. One square chain of wheat was cut for each lot from the same field: the lots adjoined each other, and were carefully kept separate through the trial. The quantity of the first and second cut was exactly alike, both in measure and weight of grain (16 stones each): there was a slight increase both in measure and weight of the last cut in grain, but I am of opinion that that arose from there being more plants on that lot; but I intend this season to try again, and, with your permission, will lay the result before the public. To make the

Early Cutting Wheat.

advantage of early reaping more apparent to all, I give the result of my experiment per acre:—

First Cut—22nd August, 1844.												
	lbs.	cwt.	qr.	lb.	s.	d.	£	s.	d.	Bread.		
Straw .	3840	34	1	4 at 2	0		3	8	6½	lbs.	£	s. d.
Flour .	1770	126st.	0	6 at 1	8	10	10	8½		2524½ at 1½d.	13	2 11½
Sharps .	150	10	0	10 at 10		0	8	11½				
Bran .	290	20	0	10 at 8		0	13	10				
Waste .	30											
							15	2	0½			

Second Cut—29th August, 1844.												
	lbs.	cwt.	qr.	lb.	s.	d.	£	s.	d.	Bread.		
Straw .	3150	28	0	14 at 2	0		2	16	3	lbs.	£	s. d.
Flour .	1730	133st.	0	8 at 1	8	10	5	11½		2407¾	12	10 9¾
Sharps .	170	12	0	2 at 10		0	10	1½				
Bran .	310	22	0	2 at 8		0	14	9				
Waste .	30											
							14	7	1			

Third Cut—6th September, 1844.												
	lbs.	cwt.	qr.	lb.	s.	d.	£	s.	d.	Bread.		
Straw .	2930	26	0	18 at 2	0		2	12	3¼	lbs.	£	s. d.
Flour .	1680	120st.	0	0 at 1	8	10	0	0		2347½	12	4 6½
Sharps .	185	13	0	3 at 10		0	11	0¼				
Bran .	325	23	0	3 at 8		0	15	10½				
Waste .	50											
							13	19	2			
Clear gain of first over last in } straw and flour. }							1	2	10½	In bread . £0 18 11½		

Making the following total—

	£	s.	d.
Straw, flour, &c., in excess, on the raw cut	1	2	10½
Making more bread per stone, ½ lb. × 126 st. 6 lbs.	0	7	10½

Total gain of raw-cut grain £1 10 9

“I therefore say to one and all, try (for, on fair trial, I have no doubt but like results will follow) and thereby know, one and all, how much we are indebted to Mr. Hannam for publishing his experiments on this subject.”

It should be added that the above experiments related exclusively to the case of the wheat crop, and that the time of cutting wheat thus depends on circumstances which do not apply to other crops. We cut wheat before it is fully ripe, in fact as soon as the seed has lost its milkiness and before the straw has wholly lost its green, because the substance of the seed then contains a maximum of flour. In the case of oats, we also cut the crop while it is still green, not, however, because any subsequent process of ripening injures the sample of grain, but because when fully ripe they are very liable to shed on being shaken by the wind or even

by the sickle, and because if cut and dried while still rather green the straw makes superior fodder. Barley, on the other hand, we leave until it is fully ripe, not because the grain is thereby directly improved for malting purposes, but because it is necessary, in order that it may malt well, to have it all of one stage of ripeness, so that when damped it may all sprout together. In order to secure, therefore, that it be of a uniform maturity, we let it all get dead ripe, which is indicated by the dryness of the straw, and by the turning down of the ear.

Besides these considerations, affecting harvest work generally, which deserve discussion in July, we have to make great preparation in other ways, to have men in readiness for it, and, if necessary, to purchase a reaping machine.

The Reaping Machine.—As soon as the summer's sun has dried up succulent growth, and converted green grass into straw, the mowing machine is displaced by the reaper. It is easier to cut and deal with dry stems than with green and juicy growth, and the reaper was thought of, and, as the solution of an easier problem, invented long before the mower. It is, nevertheless, merely the mower, with an apparatus for gathering and delivering the cut produce, which in the case of the mower is left lying where it stood, to be trodden by the horses when they come round to cut another breadth. It could not in the case of wheat and other grain crops be permitted that the horses should thus tread out the corn which had just been cut, and so in every reaper there is either a contrivance for collecting this cut corn, and letting it go in bundles, which may at once be tied and carried out of the wake of the machine and out of the reach of the draught animals when they next come round; or there is a provision for delivering the cut corn in swathe on one side. Machines of the former class are called hand-delivering reapers, and of the other class they are called self-delivering reapers. In almost all competitions hitherto, all reapers have competed with one another, and judges have had to pronounce which is the best not only in its own class but for use under all the varying circumstances of harvest work. But the fact is, that no man can say which is the best machine for all circumstances, simply because that which is best when hands are plentiful is not the best when hands are scarce. In the latter case we should greatly prefer the large self-delivering reaper made by Messrs. Burgess and Key—in the former we should prefer the hand-delivering machine of Cranstoun, Cuthbert, Dray, or other makers of Hussey's American reaper.

One of the best trials of reaping machines last year (1860) was that before the Yorkshire Agricultural Society at Pontefract. No fewer than twelve machines appeared upon the ground. They were first successively tried upon the wheat crop where it was badly laid

at one end of the field, and nine of them were selected for time trials on a portion of the field where the crop was less broken down by the weather. To these were allotted measured plots, and the time occupied by them was noted. The plots were unfortunately not of equal quality, the wheat being more laid at one end of the field than at the other; but after the completion of their respective tasks, all those machines which made fair work were taken to the laid end of the field, and tested on as difficult a piece of work as could be found. Four of the competing machines were then taken to a barley field, where three of them made excellent work, and in the end the first prize was awarded to R. Cuthbert's (of Bedale) two-horse right-hand cutting reaper, with manual side-delivery attached; the second prize to Beckwith's (of Ripon) two-horse right-hand cutting reaper, without side delivery; and the performance of Burgess and Key's reaper (shown by C. Clay, of Wakefield) in the barley field was highly commended, and the performance of Coates's (of Middleham) reaper in the wheat field was commended.

The following is a more detailed specification of the machines on the ground. It enumerates almost all the machines now in the market:—

1. Spencer's, of Doncaster, costing 22*l.* without tipping board, or rather more if with Dray's tipping board—with Hussey's cutter five feet long, in twenty teeth, driven by Wray's patent worm motion.

2. R. Cuthbert's, of Newton-le-Willows, near Bedale, one or two-horse machine, costing 22*l.*, with or without a side delivering attachment, with Hussey's cutter five feet long, in twenty equilateral teeth, driven by multiplying wheels, and making about twenty oscillations in nine feet forward motion, the knife hung at its near end in an oscillating sling.

3. J. and T. Cuthbert's, of Bedale, costing 20*l.* without any extras, with Hussey's knife five feet long, in twenty equilateral teeth, cutting against the upper edge of the finger guards, worked by multiplying wheels, and making about sixteen revolutions per nine feet forward.

4. Cranstoun's Wood's combined mower and reaper, costing 35*l.*, with revolving fans and Hussey's cutter four feet ten inches long, in sixteen teeth sharper than equilateral, worked by multiplying wheels, and making twenty oscillations per nine feet.

5. Kearsley's, of Ripon, costing 22*l.* with Hussey's knives five feet long, in twenty rectangular teeth, worked by Wray's patent worm motion; the knife hung in an oscillating sling, which is driven on Kearsley's patent from a point nearer to the attachment of the sling, so that a smaller crank motion makes an equal oscillation.

6. Bamlett's, of Richmond, costing 23*l.* as a reaper, and 33*l.* as a

combined reaper and mower, with Hussey's knife five feet long in twenty equilateral teeth, worked by multiplying wheels. Its dividing shield, by which the cut corn was separated from the standing corn, ultimately brought it to a stand by gathering uncut straws.

7. Coate's, of Middleham, costing 18*l.* 15*s.*, with Hussey's cutter five feet long, in nineteen (sharper than equilateral) teeth, worked by multiplying wheels making twenty oscillations per nine feet.

8. Beckwith's, of Ripon, costing 19*l.*, with Hussey's cutter four feet eight inches long, in nineteen (sharper than equilateral) teeth, and making above twenty oscillations per nine feet forward.

9. Wray's, costing 22*l.*, with Hussey's knife five feet long, in nineteen rectangular teeth, and making about sixteen oscillations per nine feet forward—worked by his own patent worm motion.

10. R. Cuthbert's two-horse reaper, the same as No. 2, but costing 24*l.*, and furnished with a right-handed cutter.

11. Heugh's, of Newton-le-Willows, costing 25*l.*, with Hussey's cutter five feet long, in twenty teeth, and oscillating nearly twenty times per nine feet of motion.

12. Burgess and Key's, costing 42*l.*, with McCormick's serrated knife, five feet eight inches long, cutting in seventeen intervals, making about sixteen oscillations per nine feet forward, and furnished with revolving fans, with self-delivering screw-rollers, with

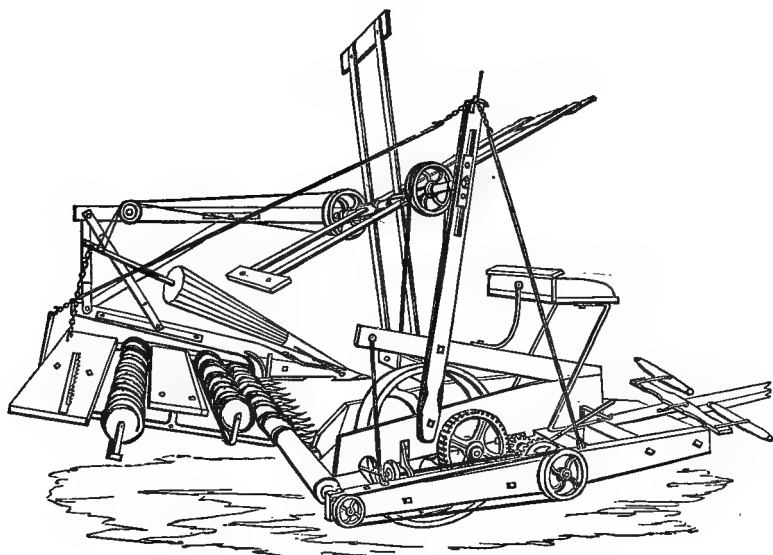


Fig. 56.—Burgess and Key's Reaping Machine.

conical divider for separating the cut corn from the standing crop, and with many means of adjustment to varying work.

The explanation given of their construction by this description will be facilitated by the drawings given in figs. 56, 57, and 58, of

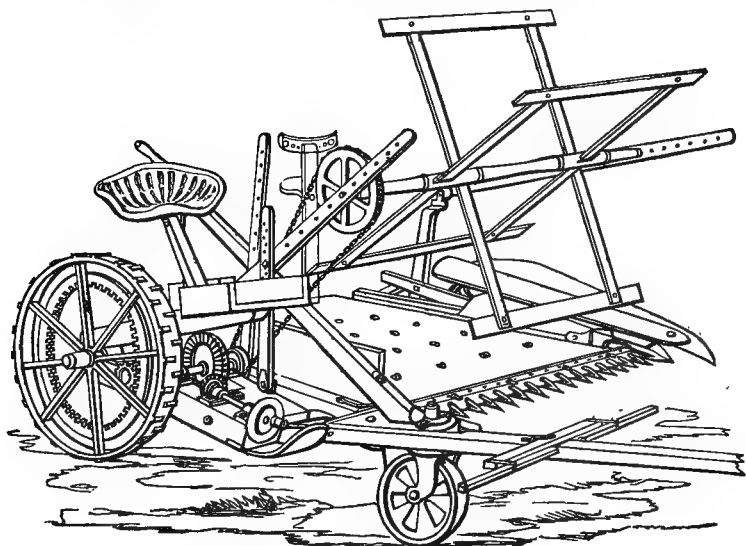


Fig. 57.—Cranstoun's (Wood's) American Reaper.

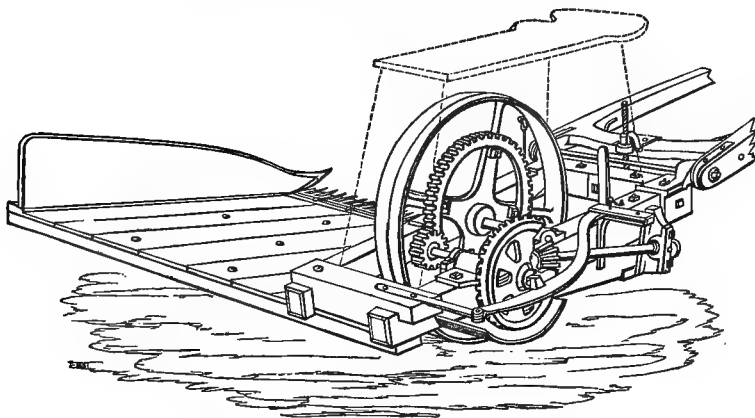


Fig. 58.—Cuthbert's Reaping Machine.

Burgess and Key's, Cranstoun's, and Cuthbert's machine respectively. In all of them the cutter is a sharpened blade of steel, about five feet long, lying across the path of the machine, and

formed either of a slightly undulated saw-edge, the serratures meeting one another on either side of the undulations, as in Burgess and Key's; or of a series of teeth, as in the other machines, about three inches wide and as many long, both sides of which are smooth and sharp. This knife lies on a bed from which there projects a series of slit wrought-iron fingers, which extend into the corn in front of the cutting edge. The knife is made to oscillate some four or five inches to and fro upon its bed, passing through the slits in the extended fingers, which at once clean it and hold the straw on which the cutter operates. This oscillating motion is effected by a driving wheel, acting through bevelled and other multiplying wheels upon a spindle, at the end of which is a crank attached to one end of the cutter. The various machines in the market differ from one another—(1) in the form of the cutter—the outline of the cutting edge; (2) in the mode of getting up the speed of its oscillations; (3) in the presence or absence of a "reel," or revolving fan, shown in figs. 56 and 57, which revolves inwards towards the cutter, and bends the corn on to the machine to be cut; (4) in the provision made for the removal of the cut corn, which falls back upon a platform. This is either level, holding the cut corn until the man upon the machine judges there is a sheaf, when he pushes it off with his rake, and it lies in the wake of the advancing machine, and must be removed before the horses come round again; or, as in the case of Burgess and Key's reaper, fig. 56, it is provided with three screw deliverers, which, as they revolve, gradually push whatever falls upon them on to the farther side, whence it falls out of the wake of the horses, and therefore out of the way of their return journey. The machines differ (5) in the mode of draught; in all the cases figured they are drawn from the side. In Bell's reaper, which is the original machine and a very efficient one, the horses push the machine before them and walk in its wake, pulling from the end of a long pole which extends behind the machine. It is thus the only implement which can "charge" the crop and cut its way *through* the standing corn. In all other cases an opening must be made by hand to obtain a fit pathway for the horses. The side-land pull of the horses tends to strain them, and the resistance met with makes them draw the machine sideways, to the straining of the implement itself. To remedy this, Mr. Cuthbert has recently patented a conical form of driving wheel, whose natural tendency to travel out of the straight line meets and overcomes this lateral strain in a very effective and ingenious way.

Of the machines thus named and described, Burgess and Key's is probably the favourite in the case of large farms and large fields. The following is an account of the experience of Mr. Wilson, of Manor House, Woodburn, Morpeth, in its use. He says:—

Burgess and Key's machine is an improvement upon the original McCormick. It is self-acting, cutting and laying the corn in a con-

tinuous swathe at the rate upon an average of $1\frac{1}{2}$ acre per hour. A boy or man seated upon the machine drives the two horses which draw it, though it is advisable to attach a third horse to the end of the pole, in case of heavy crops, or in barley—not so much for the purpose of drawing as for steadying the machine. The horses walk at the side of the standing corn, and in advance of the knife, which runs out from the wheel frame on the left side. The principal part of the weight is balanced over the one main or driving wheel, which gives motion to the knife for cutting, the reel for inclining, and the Archimedian screws for delivering the cut corn in the form of a continuous swathe. The cutting apparatus is simple, effective, durable, and not liable to choke or get out of order; it consists of an obtuse angled serrated knife, working through guard fingers, and thus saws rather than clips its way through the standing corn; this form of cutter consumes less power than any other yet introduced. As the machine is drawn forward the standing crop is inclined towards the platform by the rail, which is placed a little in advance and over the knife, and when cut falls upon a series of Archimedian rollers, by which it is carried off to the side, and deposited in a perfectly well-formed swathe at right angles to the course of the machine, leaving room for the return of the horses. A field may thus be cut without binding or otherwise moving the swathes. The revolving cone at the side of the machine (seen in fig. 56) acts as a divider, separating the corn being cut from the standing crop, and is a very useful and valuable improvement, especially where the corn is inclined across the course of the machine. The height of cut may be varied several inches while the machine is in motion, by means of the lifting gear attached to the land-wheel. The hinged side is also an essential improvement, doing away with the formerly necessary trouble of keeping the corners rounded off by hand, as the machine can easily turn at any angle without injury to the surface or seeds. This ease in turning greatly facilitates passing through narrow gateways. The bearings of the driving-wheel, moving up and down in circles, are adjusted in a few minutes, varying the height of cut from three to twelve inches. It takes a width of five feet eight inches, and will cut, on an average, from twelve to fifteen acres per day, at a cost of about 5s. 3d. per acre when stooked. I have cut as much as nineteen acres per day with one of these machines, but as much as twenty-five acres have been cut in some of the large fields of Yorkshire and Norfolk; we frequently, however, cut at the rate of two acres per hour in a nice standing crop. I think, after having cut upwards of 700 acres of corn with the same machine, I may fairly claim a right to say a word in its behalf; and I unhesitatingly give a preference to Burgess and Key's machine for large farms over any that has yet been brought before my notice. We have now no difficulty in cutting the very shortest oats

with it, and the heaviest crops of wheat; but this requires patience and a proper adaptation of the working parts, for it is unreasonable to imagine that a machine can cut every variety of crop without some little assistance. It is most carefully constructed and of the best material, to which I can testify, from the few breakages to which we are subjected. The knife will cut from fifty to seventy acres without requiring sharpening. It is a great favourite with the labourers, not requiring such hard work as a sheafing machine, and therefore more likely to succeed when introduced into a new district. It is only necessary to add, that a machine, which is a favourite with the labourers, is likely soon to be a favourite with their employers also.

Mr. Wilson tells us, that by the aid of Burgess and Key's reaper, he cuts the whole of his corn crop with his usual staff of farm labourers, twenty-seven persons, viz., nine men, nine women, and nine boys or girls—together with a man and boy with the machine. These work in gangs of three—a boy or girl to make bands, a woman to sheaf the corn, and a man to tie and stook. In this way nine swathes are taken up at once, and as the machine generally works round the field, they also go round, but in the opposite direction. It is found that a gang, *i. e.*, a boy, a woman, and a man, can sheaf and stook, when well laid, two acres a day, or on an average, one and a half acre a day—the nine gangs doing thirteen acres a day, which has been the ordinary performance of this reaper.

The following paragraph again describes the experience of its use upon a Surrey farm. By its aid in 1857, 176 acres were here reaped, and tied, and stoked for 38*l.* 19*s.* 7*d.*, or 4*s.* 5*d.* per acre. In 1858, 179 acres were harvested for 40*l.* 17*s.*, or 4*s.* 6*d.* per acre. In 1859, 183 acres were harvested for 41*l.* 2*s.* 8*d.*, or 4*s.* 5*d.* per acre. In the difficult harvest of 1860, 203 acres were harvested for 52*l.* 17*s.* 8*d.*, or 5*s.* 1*d.* per acre.

Of course every one knows that the mere cost of an operation is no criterion of its economy—that, in particular, cheap and careless harvest work is often dear enough in the end—that tying and stooking a good crop will alone often cost 5*s.* an acre—and that slow and costly hand-reaping carefully performed may be cheaper in the end than hasty and ill-done harvest work by machinery. Nevertheless, it is well worth knowing that by the aid of Burgess and Key's reaper the cutting and tying of crops of average bulk is in this instance done to the satisfaction of an energetic farmer for 4*s.* 6*d.* to 5*s.* an acre. This sum includes wages and repairs, but no charge for horses. How satisfactorily and rapidly the work has proceeded is plain from the fact that the driver of the machine is paid for his work at the rate of only 2½*d.* per acre; the average performance during the season, extraordinary as it may seem, having actually

been twenty acres daily, cut by two pairs of horses, which are changed for one another during the day.

The machine now in use has not, during the three seasons it has worked, needed 30s. of repair, but a new knife and one new belt are now procured for the coming harvest (1861).

Take now another case, where Cuthbert's reaping machine (fig. 58) is used. Mr. Chadwin, of Tollard Royal, near Salisbury, thus describes his use of it during the unpropitious harvest of 1860. He says, in the *Bath and West of England Society's Journal*:—

The past season severely tested the merits of the various reapers. In no season have the corn crops been so much laid, or so full of grass and weeds, making it very difficult for any machine to work without clogging. The reaper used by Lord Rivers this season, upon one of his arable farms of 600 acres, is one of Cuthbert's one-horse reapers, and it has proved itself clever and efficient, going through the whole of the past harvest without costing a fraction for repairs—cutting crops which were very much laid in the most satisfactory manner. Its work is far preferable to the work of the scythe in all crops, but more especially in the barley crop, when it has become dead-ripe, and the ears bent, and nearly beaten into the ground. It is well known that the scythe in this case does much damage by cutting off the ears to a very serious extent, which is almost entirely avoided by the use of a reaper set to work low. My own practice during the past wet harvest has generally been to keep on cutting oats and barley; and, when a fine day or two *did* occur, to send the reaper into the wheat (the wheat being dead-ripe), and cut, bind, and cart at the same moment, stacking it in small ricks, thus making rapid progress—showing the advantage of machinery over hand-labour. Despatch is not its only recommendation, for it leaves a balance in money in its favour in comparison with hand-labour. The following figures will show the comparison between the two systems on this farm:—

BY HAND LABOUR.	Per acre.
Reaping, tying, and stooking . . .	10s. to 12s.
Mowing, tying, raking, and stooking .	7s. to 9s.

BY MACHINE.

The reaper averaged about ten acres per day:—

	s.	d.
Two men, at 5s. each per day . . .	10	0
One boy	1	6
Oil, say	0	4
Food of two horses	4	0
For ten acres	15	10

Or, per acre for the cutting, 1*s.* 7*d.*

For tying, stooking, and raking, 3*s.* 6*d.*

Total cost per acre by machine, 5*s.* 1*d.*

The above prices include beer in every instance.

Although this reaper is called a one-horse implement, it in reality needs two horses per day, the work being too hard for one, therefore they relieve each other at intervals; this is the usual practice: but I have found it much the best plan to feed the horses highly, and work them both at the same time throughout the day. The pace is quicker, the horses are less fatigued, and fewer stoppages occur. I do not work the same pair of horses two days in succession. This reaper may possibly cut an acre or two more than I have stated in a very dry season.

As another instance of successful harvest work we quote the experience of Mr. Spearing, of Moultsford, near Wallingford. He has used one of Bell's reaping machines for several years. He does not aim by means of it to cheapen his harvest work so much as to quicken it, and thus accomplish it, as Mr. Wilson does, with his own ordinary set of farm labourers; and so effectually does it and other machinery upon the farm enable him to equalize the hand labour of the year, that he is one of the very few farmers who find it takes as many men in winter as in summer to get through their work satisfactorily. The machine is let to the men for their assistance, horses being supplied. It goes round the different gangs, to whom the work in the several fields is let, and helps each in turn, so that in years of a standing crop very little needs to be done beyond gathering, and tying, and stooking. Of course the hastening of the harvest work is an achievement very often of the greatest value; and in this way Mr. Spearing is repaid for the purchase of his reaper: but he is also repaid by the actual improvement and the constant good-will of his labourers. How well their interests are served by such an arrangement is sufficiently plain; and attention will be hereafter directed to Mr. Spearing's experience of the advantages attending a more friendly relationship between master and men than is commonly witnessed.

Cranstoun's machine (fig. 57) is also of the greatest value as a reaper, and is preferred in many quarters to all others. It is largely and successfully at work, as a list of Mr. Cranstoun's customers before me proves, and as frequent observation of its performance in the field enables me to testify.

Colonel Kingscote's farm-manager writes as follows about it from Kingscote, Gloucestershire:—"Its durability is everything that can be desired. We have never had a breakage, with the exception of one cogwheel broken by driving against a tree; and after mowing and reaping over 400 acres, it is very little the worse for wear. As a reaper when the corn stands it does its work exceedingly well,

is easy draught for two horses, gets over one acre per hour, and a man puts the corn off in sheaves quite satisfactorily. Tying, stooking, and raking, I let at 4s. per acre. Under such circumstances, it is a great advantage to a farmer; but when the corn is laid, it will only act one way, thus doing half the quantity of work."

I add as a last testimony to the perfect efficiency of the reaping machine in its many different forms, as an implement of the farm, the following communication from Mr. Patrick Shirreff, of East Lothian. The initials are those of Lothian farmers well known to the writer. He says:—

Two very successful competitions took place during last harvest (1860), one at Longniddry, in this neighbourhood, and another at Cleifton, in West Lothian. In both instances, all the machines worked throughout a long trial without either stoppage or breakage. But let me first state the ordeal to which the reapers were subjected.

The test of excellence was the manner in which the work was performed. Now in every case this was owing far more to the expertness of the people attending the machine than to the machine itself: and it sometimes happened that the reaper which made the best work and the reaper which made the worst were identical in every respect. In neither of the competitions alluded to had the ground been prepared for machine reaping, and occasionally a reaper was slightly affected by coming in contact with a stone; but the injury did not arise from any defect in the reaper, but to ill-luck in the allotted space.

Mr. J. H. thinks Gardner and Lindsay's reaper the best which appeared at Longniddry.—Mr. J. T. uses both Bell's and Gardner and Lindsay's readers, but gives a decided preference to Bell's. He says that Bell's reaper with a delivery like the dancing shakers of the threshing machine (Dockery's shaker) would form the best reaper, and he has taken steps to construct one.—Mr. H., of H., has for many years past cut all his crops with four of Bell's reapers, the ground being hilly, and extending to nearly 1000 acres yearly.—Mr. S. S., from his experience of the past harvest, prefers Bell's reaper to Gardner and Lindsay's.—Mr. J. T. thinks Douglas of Kirkaldy's reaper the best which appeared at Longniddry. It is characterized by a self-delivery in sheaf, but the delivery was not complete, and many people considered Douglas's machine the coming reaper.—Mr. J. H. prefers Halliday's reaper with a tilting board resembling Hussey's.

Many more agriculturists of our acquaintance could be brought forward to testify to the reaping machine, but as a general rule every person is partial to the reaper which he himself uses.

Mr. A. H., who furnished the crops for the competition at Longniddry, and closely attended on the competition, says that four or

five reapers performed equally well, and that it is immaterial which of them is selected to operate.—Mr. A., who furnished crops for the West Lothian competition, and who obtained the first and second premiums with Gardner and Lindsay's reapers, says that he prefers the reaper made by Kemp, Nicholson, and Murray, of Stirling, to all others.—Mr. J. M. thinks Cuthbert's two-horse reaper the best, chiefly on account of its lightness of draught and its adaptation to hilly land. He also says that Burgess and Key have sent out an excellent light reaper.—Mr. G. G., who acted as one of the judges at Clefton, and who had a good deal of controversial correspondence regarding it, told me that he considered four or five of the reapers equally good, and that any difference in their performances was owing to the people attending them.—Mr. P. M., also a judge at Clefton, told me in Edinburgh Corn Exchange, that he considered Kemp, Nicholson, and Murray's, and Cuthbert's, the best reapers, but could not decide between the two; and on calling three or four farmers to his aid, we found that no two of them agreed in opinion.

I myself witnessed the competition of reapers at Longniddry, and came to the conclusion that four or five of the reaping machines are equally effective. No doubt the driving principle of the machinery differs in some, and so also does the principle of delivery; and in these respects must the superiority of one reaper over another lie. I did not minutely examine the driving gear of all the reapers, nor their mode of delivery; and even if I had done so, my imperfect knowledge of mechanics might not have enabled me to decide correctly. The tilting board for assisting to sheaf is in great favour, but there are certain states of crops as well as of weather when it is proper to lay the cut grain in swathe, so it is desirable that a reaping machine should either sheaf or swathe the crop at pleasure, but no such reaper has appeared. It may now be held as certain that the cutting of four or five different reapers is equally good, perhaps faultless; that all of them may be constructed of the same materials, and of any required size, and that none of them are liable to break nor difficult to repair. I saw reapers going empty as well as cutting the crop across ridges, while the horses were trotting. It seems to me of no great consequence whether a reaper only cuts one way or cuts both in going and coming across a field, because in the one case double the number of hands would be required, while in the other the horses have a relaxation from labour. From nine to twelve good hands are required to bind and stook to a sheafing reaper, cutting one way at ordinary speed. With an increase of speed there ought to be additional hands to keep all tidy. Two machines cutting but one way will do considerably more work than a machine cutting both going and coming, while the assisting hands perform their tasks more satisfactorily. The reaper

which cuts one way could be employed as a rake in returning, provided due care were taken to place the stooks in a straight line.

In East Lothian nearly two-thirds of crop 1860 were cut by reaping machines, and I now consider them to be fairly established as an implement of the farm, and that their use is likely to extend yearly. The position which the reaper has now taken with us is perhaps less owing to the improvements which the machine has recently undergone, than to the prejudice against it softening down. Formerly nearly all of the farm servants and the whole of the itinerating harvesters were hostile to the reaper. Now, the ploughmen are interested in its success. I cannot conclude without saying, that however well Bell's reaper may cut and lay down the crop, the machine is so unwieldy as to be entirely out of date.*

I add further that the machines named, with the exception of Bell's, and Burgess and Key's reaper, already referred to, are implements of the same class as Cuthbert's, *i. e.*, modifications of Hussey's American reaper. The tilting platform named above was a device first adopted in Dray's form of Hussey's reaper, and consists of a balance platform, held in its position by the foot of the man who rakes the straw from the machine, and who is assisted by being able thus to lift the platform into an inclined plane, and facilitate the delivery of its load. The number of all classes of these machines now in use may be gathered from the fact that up to January, 1861, when they had been only three or four years in anything but merely experimental use, Messrs. Burgess and Key had sold about 2800 of their reapers, of which near 800 a-year were sold during the past two years. Crosskills had sold 500 of Bell's reapers and 800 of Hussey's; and of the various other forms of Hussey's reaper, made by ten or twelve separate manufacturers, many thousands must have been in use last harvest (1860). Dray has sold 800 of his form of it. Mr. Cranstoun tells me that he has sold 50, 250, and 498, in three successive years, of Wood's modification of it. The Cuthberts, of Bedale, have sold 30, 100, and 500 of theirs. Mr. Wray, of Leeming, near Bedale, in the last six years has sold 7, 15, 26, 18, 95, and 312 of his. And how extensively the machines of other makers, less known at our end of the island, are employed in Scotland, may be gathered from the fact, that in East Lothian alone 119 machines, by Gardner and Lindsay, of Stirling, were last year employed.

Harvest Work.—To turn, however, now from the means of harvest work, I must enumerate certain particulars of the harvest work to be done this month. Among them is the continuance and completion of haymaking, to which reference was made last month,

* At the Leeds trial (August 22, 1860) Bell's reaper has been shown, much lighter and very much improved, &c.

and on the cost of which I will now only add the following testimony:—

Some weeks ago (July, 1861) a correspondent of the *Agricultural Gazette* complained that among the costs of making ten acres of hay near London, his bailiff had charged 3*l.* 8*s.* 6*d.* worth of beer. The charge was preposterous—a gallon of beer per acre during mowing, and as much during making, is a liberal allowance; while in good weather the whole cost of mowing, and making, and ricking, exclusive of horse labour, ought not to exceed 10*s.* per acre. Another correspondent, however, expressed his surprise at this estimate:—Having 400 acres to secure, he could never get it done much under 30*s.* an acre, with the aid of haymaking machines and horse rakes, but not mowing machines. He had this year let 150 acres for 23*s.* an acre, and had found horses, carters, and machines, and it did not pay the contractor.

Now in answer to this it may be repeated, that 10*s.* per acre is the cost at which the cutting and making of large quantities of hay in Gloucestershire is often let, barring only the employment of the farm teams in carrying it; but the cost no doubt varies both with the crop and the wage of the locality. When 2*s.* and beer is a satisfactory wage, and one ton per acre a satisfactory crop, hay-making must cost less than where 3*s.* with beer and a couple of loads per acre are the wage and crop respectively.

The following is information recently received on this point from Gloucestershire farmers:—(1) The first occupies a dairy farm of two or three hundred acres in the vale of Berkeley. He has “no accurate account of what it has cost” him in any one year for hay-making, but he states what he “considers it has cost per acre annually.” He always mows from 100 to 120 acres a year, and generally lets his grass “to mow and make, at 8*s.* an acre, with a horse and hay tedder to go over it once.” Without this machine he must give 9*s.* at least, and he considers it costs him 2*s.* an acre for beer and cider in addition to this, and then 2*s.* more for his men to stack it away, making with the machine 12*s.* an acre, and without it 13*s.* an acre. This does not include thatch, “for which probably 1*s.* an acre more must be charged.” We know this farm perfectly, and know its tenant to be one of the best dairy farmers of the district.

(2) Mr. Harrison, of Frocester Court, who occupies one of the best dairy farms in Gloucestershire, extending over about 500 acres of the rich calcareous loam stretching from the oolitic hills into the vale of Gloucester, has been kind enough to give the following particulars of his experience during the last ten years in the cost of haymaking:—

In 1851, the whole cost in manual labour, *i. e.*, mowing, making,

carrying, ricking, thatching, over 123 acres, was 7*s.* 6*d.* per acre. In 1852 the cost over exactly the same extent was 8*s.* 8*d.* per acre.

In 1856 the whole cost of mowing and making (including some acres of clover), "thatching and all," was 8*s.* an acre over 145 acres. In 1857 the whole cost over 154 acres was 6*l.*, or about 8*s.* an acre.

In 1859 the mowing machine was used in addition to the hay-tedder and horse-rake, and the whole cost of manual labour in mowing, making, carrying, ricking, and thatching 170 acres, was only 6*s.* an acre. The quantity of beer and cider consumed is about two gallons per acre during the whole process; but of course it and every other item of the cost varies immensely with the weather. Where that is difficult the process is correspondingly tedious and expensive. But the figures given state accurately the whole cost incurred in the years which have been named. The following particulars of crops and labour may be added. The weight of hay per acre on this farm is put at from twenty to thirty cwt. per acre. The same men all the year round are employed, and extra hands (excepting a few women) are rarely engaged at haymaking time. The men have the same wages as at other periods of the year, viz., from 1*l.* to 12*s.* a week. Cider is given to them in addition during this harvest work. From 8*s.* to 10*s.* an acre is the ordinary rate of the neighbourhood for contracts to mow and make hay; but the plan is not generally approved of. If the weather be fine it can be made for less, and if not, the persons engaged to make it for you are rarely a sufficiently large party to make the most of the favourable intervals, and the hay is spoiled. In the case of two seasons whose details have been supplied, the labour of making 145 and 154 acres respectively lasted between mowing and thatching from June 14 till August 1, and from June 5 till August 7, respectively. The cost of mowing has been generally 2*s.* 6*d.* per acre, with 9*d.* extra for beer and cider.

It must be added that, in the case of Frocester Court Farm, a large quantity of the hay is placed in barns, which saves the cost of thatch; and that when hands are hired for the haymaking, the cost turns out excessive, because the work is sometimes delayed by the weather, and though the hands are then turned off to turnip hoeing and other work, yet the wages are charged to the crop for which they were hired.

Rye-grass seed, especially that of the earlier Italian rye-grass, is generally ripe before August. It may be cut in swathe by the common scythe, which should be followed by women tying the swathe up in small sheaves, and stooking them on the ground like a crop of corn. When dry, the sheaves are either carried to a board upon a sheet in the field, where a couple of flails will knock the seed out as fast as the sheaves can be thrown down to them,

for a couple of blows is all that they need ; or a large box on low wheels may be drawn by the stooks as they stand, and the sheaves may be then taken hold of at the lower end, and simply beaten two or three times upon the edge of the box, and all the seed will fall from them into it.

Pease are often ready to cut towards the end of this month. This is done generally with a short scythe, by which they are half mown, half "bit off"—the mower working round successive bits, and cutting each into a bundle where it lies, and is turned once or twice until it dries.

Winter beans, too, are generally ready to cut, or pull, towards the end of this month. They are cut with a heavy hook, after the manner called "fagging" in some counties. Or they may be pulled when the straw is short, and the plant comes up easily, and without earth clinging to it. When pulled, though it be after the leaf and pod have somewhat blackened, if the stem still retains some sap, the straw makes useful fodder, cut into chaff and steamed along with other food.—The earlier oats will often be ready to cut in July.

Flax may be ready to pull towards the end of the month. For the finer qualities this should be done before the seed boll is brown ; but for crops of ordinary quality it is more generally work for August, when it will be particularly described.

July is, indeed, more a month of preparation for the main harvest work. To this end, all turnip hoeing should be completed as far as possible ; barns and rickyards cleaned out ; thistles and other noxious weeds in the hedge-rows, in the pastures, and by the roadsides should be cut down ; heaps turned, so as to render it unnecessary to take harvest-men away at a later season from their proper work. Straw should be got ready and "leased" for thatchers. Agreements also may be made for reaping, and fagging, and mowing, and following the reaping machines, during August, &c. Day wages will rule from 3*s.* to 4*s.* and even more during the harvest months.

VI.—CULTIVATION OF CROPS.

Turnip Culture and even turnip seedtime extends into July and beyond it. A great deal of the useful effect of the crop upon the ground depends upon its treatment this month. When singled out, the horse-hoeing should be repeated at short intervals. The following is the report of a Hampshire farmer, in the middle of this month, and it relates both the sowing and the hoeing of the turnip crop :—

"The last few days our horses have been busy preparing land for common turnips after tares, trifolium, &c., which we do in the fol-

lowing manner. The land having some couch grass in it, we shallow rafter* plough it, then work it fine by harrowing and rolling, then collect and cart off the weeds and grass; afterwards scarify and work fine, and collect grass as before. We prefer this mode of treating the land to that of deep ploughings, for cleaning the land previous to the final ploughing or seed earth. Our odd horses have been horse-hoeing carrots, and also swedish turnips.

“After the second hoeing of this crop it is well to use a small one-horse plough, or the common plough without its mould-board, between the rows. It should pass down each side of each row, opening up a deep but very narrow furrow, and throwing the earth *from* the plants. If two ploughs work at this they will proceed as fast as one horse-hoe, which should follow them, and as each interval is completed, this hoe should be used to level the drill ridge which has been raised within it. The effect of the whole is the more thorough cultivation of the land.”

The drawing on the next page represents a useful form of the horse-hoe. It is furnished with a front paring tooth and with two side teeth, also provided with paring edges, which project towards the cutter and then clear the whole surface of the land; a small harrow is suspended from the handle which shakes out the weeds just moved by the paring teeth. When the land is clean and only stirring is wanted, the harrow may be dispensed with, and stirring teeth may be substituted for the parer.

The singling of turnips sown upon the ridge may be done by women, who will accomplish a quarter of an acre daily each with ease. The line of plants is left by the horse-hoeing and paring upon the summit of an abruptly-made ridglet, and this is bevilled off by alternate thrusts and pulls of an eight or nine inch hoe, which leave single plants at intervals of ten to twelve inches along the top line of an even-sided ridge.

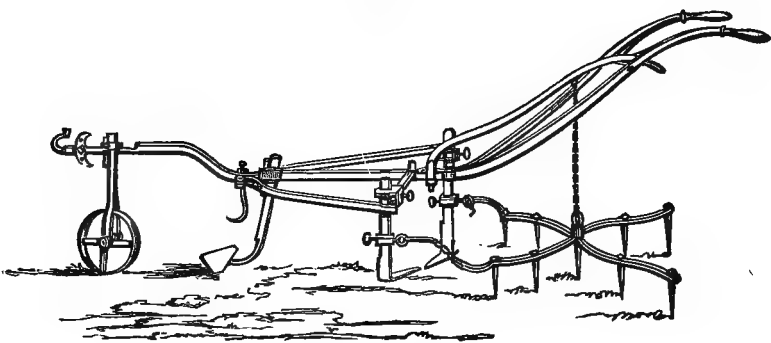
When broadcast turnips are the rule, the work of hoeing is generally let to hands accustomed to it, who contract to hoe twice or three times for 8s. to 11s. an acre. The following are the instructions given in the original edition of this work if regular and accustomed hands are not to be obtained:—

Supposing turnip-hoers to be scarce, or to demand extravagant prices, or none to be had, order some hoes to be made by your blacksmith: the iron part nine inches long, and three or four broad, neatly done and sharp: put handles five feet long in them. So provided, take your men into the field, and yourself with a hoe should accompany them; make them hoe the crop boldly, and not be afraid of cutting too many up. Direct them to strike their hoe round every plant they leave, and fix upon the most vigorous and

* Rafter ploughing is ribbing, each furrow slice is thrown upon its own breadth of unmoved land.

healthy growing ones. By this means they will leave the plants twelve inches asunder; for, their hoes spreading at every cut nine inches, they cannot spoil your crop by not cutting freely. This work must be done by the day, and you must attend the men well, to see that they cut the land pretty deep, so as to kill all the weeds, and also such turnips as they strike at. In about a fortnight after, send them in again to rectify former omissions, in which time they must break all the land again with their hoes, cut up the remaining weeds, and wherever the turnips were left double, thin them. The men will be awkward at this work the first year; but by degrees they will be able to do it well, and by mixing new ones among them every year, "the art will not be lost."

Fig. 53.



Busby's Horse-Hoe.

Let it be remembered that broad-cast sowing of all turnip crops, except they be the later sown, is careless management. They should be drilled in rows, either on the flat or on raised ridges, as already described; and the process of hoeing is then more easily conducted. Mangold wurzel will need horse-hoeing at intervals during July, and a second hand-hoeing, too, if not already done, should be given. Blanks may be filled by transplanted roots, or cabbages may be dibbled in.

During July and later, when the common turnip and swedish turnip acquire a large leaf, the turnip fields, having escaped the fly, to which reference was made last month, may be ravaged by the black caterpillar. This grub is hatched from the egg of an orange-coloured fly, termed *Athalia spinarum*, which appears in May, and lays its eggs in the leaves of the young turnip plant, preferring those of the common turnip to those of the swede.

There can hardly be said to be any artificial remedy for a crop thus attacked. Wet weather will, however, put an end to their ravages in a few hours, though rolling, and dusting with lime, and

disturbance by light bush harrowing, or by drawing a rope over the field, may have utterly failed. Caterpillars are purged by wet food, and rains will thus destroy them in a short time. Ducks and poultry will destroy large numbers, but it is rarely that any artificial remedy is practically available. Mr Curtis, in the second volume of the *English Agricultural Journal*, gives full details of their natural history and their agricultural relations.

Turnip seed ripens in July, and should be cut when dry, and threshed out in the field.

Rape or Cole-Seed may be sowed through all this month, which is indeed the principal season for it. The preparation of the land is exactly the same as for turnips: and it has equal success with turnips when sown on pared and burnt land, which secures a better crop generally than any method of manuring. Two or three, and even four quarts an acre of the seed are sown. It is not common husbandry to single it carefully in the rows; a hoeing is however given between the rows. Upon peat soils pared and burnt (as in the fens of Cambridge and Lincoln), it is reckoned much superior to turnips for feeding and fattening sheep. In some places they hoe it very carefully, and mowing the crop with scythes, give it to stalled bullocks with the greatest success: upon very rich soils, no system can well be superior to this. Where the first sowings of turnips may have failed by the end of July, some farmers prefer sowing cole-seed rather than turnips a third time.

Cabbages.—The crop planted in April or May must be looked to this month. As it was both hand and horse-hoed in June, perhaps it will not want any more culture till August; but this depends on the season. If the weeds grow, let them be killed; for the best rule in this matter is, to hoe sufficiently to keep the crop perfectly clean, and to horse-hoe whenever the intervals have been bound by rains or otherwise.—This rule also describes the treatment of early planted kohl rabi.

The cabbages planted last month must be hand-hoed before the middle of this; in which work you should be attentive to cut up all the young weeds that grow near the plants, and break all the land on the tops of the ridges; but the men need not hoe the sides of them or the furrows, as the plough in horse-hoeing will cut them much better. The first horse-hoeing should be given soon after, in which operation the plough should take off a furrow from the ridges on each side, and throw up a small ridge in the middle of each interval, which will let the air into the earth on which the plants stand, and pulverize and sweeten it. The cabbages will be left on a narrow slip of earth ready for a second hand-hoeing, which will be given with ease. This work must be done with care and attention, for if the plants are left in too small a space, and the sun be powerful, they will suffer: the strip of earth the plants are left in should

be nine inches wide ; and if the weather is very hot, a furrow may be turned back again, at least on one side, as soon as may be. Afterwards the horse-hoeing should be given with the shim of three shares, as represented in fig. 53; the front one *low*, for cutting the bottom of the furrow in the intervals, and the others four inches higher, for cutting the sides of the ridges without removing too much earth from the plants. This tool may be followed after a time by the double mould-board plough, to sweep out the furrows and round up the ridges.

The cabbages drilled in April where to remain, must now be horse and hand-hoed ; and in the latter work, whenever it is executed, well pulverized earth free from weeds should be drawn to the stalks of the plants.

Carrots.—The carrot and parsnip crops may want a hoeing this month, which should be given while the weather is dry. These operations are never neglected, but the farmer is sure to lose a guinea for every shilling he saves.

Italian Rye Grass will, if the land was liberally treated with liquid manure after the first cutting, yield another in July.

Lucerne will be ready to cut again this month : if it was drilled for horse-hoeing, the intervals must be horse-hoed. In respect to hand-hoeing, the best rule will be to do it according to the growth of weeds : there is no necessity for it while the rows continue clean. The weeds that rise among the plants in the rows should be plucked out, and particularly all grasses, which are the greatest enemies to this crop.

But if the lucerne was sown either broadcast, or in drills at nine inches, probably nothing need be done in cleaning this month ; as one or two scarifyings in the year will keep it sufficiently clean.

The Hop Farm.—The principal work in the hop-grounds is that of hilling and beeking, followed up by the horses with the nidgets (see past *Monthly Calendars*). Under ordinary circumstances, the ground is kept constantly moved by these means for a long period.

Fallow operations of all kinds may be continued during July whenever leisure or weather permits : the horses may be employed in giving another furrow to the bare fallows, subsoil-ploughing drained clay soils, or in carting lime and manure. As to the operation of liming, I add the following passage to the instructions given last month. In it Mr. J. H. Burbery, of The Chase, Kenilworth, has been good enough to describe for us what he considers by far the best plan of applying a dressing of lime :

“ Suppose the quantity applied to be twelve quarters per acre. I would lay it, in three equal-sized heaps, on a space of ground 120 yards long and 40 wide, that being near enough an acre ; slake it with water from a cart, or carried with buckets, as most convenient ; let it lie one day, and then set men with wheelbarrows to

spread it equally over the ground. The average distance the men will have to wheel the lime will be about ten or twelve yards, and one man will spread two acres a day. The great advantage of this plan is, that neither cart, horse, or harness are required or injured by the burning lime. The men, too, arrange their work to the wind, so that though the lime is burning hot, they scarcely suffer at all from the effects of it. My men prefer this method of spreading to any other."

Fences.—I quote the following from a paper on Fences, read by Mr. Martinson some years ago, before the Newcastle Farmers' Club:—"The weeding and otherwise cleaning the hedges should be done twice every year, until the hedge has surmounted every obstacle to its growth. The hedge should be carefully pruned the second year, in order that it may get thick and bushy. This is a very easy operation, performed with a hedge-knife. I would recommend it to be done twice a year—once in winter, and again in the latter end of July or in the beginning of August. In fact, I would follow the advice of a very intelligent and respectable gardener and nurseryman in Scotland, who, when asked this question, 'When is the best time of the year to prune thorn hedges?' answered, 'Whenever your knife is sharpest.' It is of great importance to have a sharp instrument with which to perform this operation, which must always be done by an upright stroke of the hand. I do not like the principle of cutting or dressing hedges with shears. The cut is not so smoothly made; the surface is therefore more liable to be injured by wet; besides, a man with a good switch knife, who is an expert workman, will do double the quantity in a day than he would do with the hedge shears. When two men are employed at one time in switching the same hedge, viz., one on each side of the fence, they ought to begin at different ends, the one cutting up the hill and the other down. The thorn hedges I would continue to prune once a year, after they have attained the height of about four and a-half feet. Indeed, I do not see much necessity for having them higher than that at any time. They ought to be about two feet wide at the bottom, and taper away to a point at the top, at the height above stated. For want of attention to the pruning and dressing of hedges, we are called upon repeatedly to look upon naked, stunted, open, and unsightly fences. If some of those have got any dressing at all, it has been performed on a principle which cannot be too highly denounced; I mean that of cutting off the under twigs, whilst the higher branches are left to overhang the roots of the hedge, and ultimately ruin the fence. This is what farmers call the dressing up of the dyke-side. It is certainly more like dressing out the dyke's heart."

Details.—It is proper to add that the end of July, and before corn harvest, is the most convenient time during which to see that

everything about the buildings, roads, fences, and implements of the farm is in proper order. Harvest carts and tools should be put in thorough repair; granaries, barns, stables, &c., should be cleaned, and, if necessary, whitewashed. Any painting of implements or of any woodwork should be done. Straw should be made ready for thatch; and straw ropes, where they are used for thatching, should be prepared. Roads should be repaired, the grass edges of fields mowed, and fences trimmed. The cropping of quick-set thorn fences is done generally in July. Much work is often done in carting out manure to fallows and ploughing it in. When laid in heaps, these should be at once covered over with earth, and when spread in the field it should be ploughed under as quickly as possible. This also is the time for cleaning out and paring all water-courses, field ponds, and ditches. It can be done with least labour and discomfort when the water is lowest.

VII.—THE LIVE STOCK.

Horses are rarely overworked during July, and they receive in general nothing but cut green food and pasturage.

All this month, the teams should be soiled daily with lucerne, vetches, or clover, in the house or yards; and if in the latter, they must have water always at command, and also sheds for shelter; and if the farmer does not provide plenty of litter for treading into dung, he neglects a great part of his profit. Lucerne is the best plant for this purpose, and an acre of it will go much farther than of anything else. Clover and tares mown every day will answer well in the same use. In want of these give natural grass; but any of them are better, with plenty of litter for dung, than turning the horses or oxen into the field. Where the teams are well done, they get, in addition to this green food, about a bushel of oats each weekly, mixed with chaff for their nosebags.

The following is the report of a Hampshire farmer in July:—
 “Our summer vetches being now in excellent condition for soiling, we give them to pigs, cows, and horses; our horses always receive their green food in the stables, as we are greatly opposed to the practice of turning them out either in the fields or in open yards; we find that working farm-horses, from being turned out, are subject to more accidents, and also casualties, in regard to their health and well-doing, besides the great loss of manure consequent upon being out of the stable.”

Fatting Cattle.—Careful graziers make it a rule, however extensive their farms may be, to ride round and see every beast in every enclosure at least once a day. Fences demand perpetual attention, and high-fed cattle are apt to break their bounds, if this article suffers through neglect.

Beasts that are soiled in stalls or yards have, through all this season, plenty of food, supposing a proper succession of those crops which have been often mentioned for this use.

The Dairy.*—The use of saltpetre, before recommended in cheese-making, should by no means be neglected now; it will have great effect in keeping the curd sweet, which is of importance. In cases where it is allowed to become sour, the fat separates from it, and passes into the whey, where it may be seen swimming in large particles very different to the appearance of the cream which rises upon it when the cheese is sweet. The difference is easily discovered by an experienced eye, and care should be taken to prevent the cheese becoming impoverished by neglect in this branch of management. When in the loft the sour cheeses are soon discovered; they become hard, and nothing will cause any blue coat to rise upon them; every sour cheese is at once discovered by the factor as inferior in quality. Want of attention in scalding the utensils will also make the cheese sour. It is requisite also to pay great attention to the management of the cream during the warm weather, the quality of the butter so materially depending upon the care thus exercised. When taken off the milk, the cream should be put in the coolest place that can be provided for the purpose; when the convenience of an underground cellar offers itself, it is better for the cream than the dairy where much heat is caused by the process of cheese-making. Attention should be paid to frequent stirring and changing the utensils containing the cream; the churn should be prepared by having a quantity of cold water allowed to stand in it some hours before the cream is put into it, and the operation of churning should now be performed very slowly, and either early in the morning or in the cool of the evening. If the latter, the butter should be worked and salted, and allowed to remain until the morning before being made up, when it will be sufficiently firm and in a proper state for working into any form desired. It is a very good plan to put a little saltpetre, about the size of a walnut, pounded, into each cream tin; it will keep it cool and prevent fermentation.

The cows may get a change to the aftermath in the newly cleared hay fields, and even should this grass be short, it is young and fresh, and tends much to milk, so that the yield of the dairy cows may be kept up to its former quantity some weeks longer by allowing the cows frequent change in these pastures. If the weather has been such as to allow of a rapid growth of this young grass, so that the cows readily satisfy themselves and they feed eagerly, great care should be taken so that they can only have access to it a few hours daily at first, as they are very liable to suffer from "hoove,"

* Gloucestershire dairymaid in the *Agricultural Gazette*.

which is often dangerous or even fatal in its consequences. New pastures and fresh aftermath are not wholesome food for the weaning calves, and high, dry situations should be chosen for them. Old "seeds" are perhaps the best for them, and calves so fed have proved much less affected by the most common disease, from which most dairy farmers suffer greatly in their stock of weaning calves, viz. the "hask," which begins to show its symptoms at this season. A frequent cough with loss of flesh and refusing food are two sure signs of the disease. Many remedies are resorted to, as lime-water and turpentine, both of which will destroy the worms which are the cause of this disease; but none can be relied on as at all sure to effect a cure when the lungs have taken the disease. Every means of precaution should be carefully tried, and keeping the calves on dry old pastures has proved conducive to their health. The other disease among young stock which admits of no certain cure is the "quarter ill" or "evil;" this generally seizes on those in the best and most thriving condition; and if calves are fed on very rich pastures this disease is often fatal to numbers of them the first or second year. If convenient, they should be brought into yards at night, and fed on cut clover or Italian rye-grass, as keeping them from food while heavy dews are on the pastures has proved good for keeping them in good healthy condition. Care should be taken, as the weaning calves get their longer and thicker coats, to see that they do not suffer from being infested with lice, which are chiefly found about the head, neck, and shoulders, and hinder the animal from doing well. A dry day should be chosen when the calves should be well washed with buttermilk mixed with oil or grease; this simple remedy is quite effectual to destroy the lice, and restore the coat and skin to a healthy state.

The Flock.—Where folding is the system, it should this month be followed with unremitting diligence: the lands usually fixed on for this purpose are the wheat fallows; but the rule is to fold those first which will be first sown. During this month, fold such fields as are destined for August-sown grasses, of whatever sort, or tares: if the manure is left long before sowing, the benefit reaped by the crop will not be nearly so considerable.

Before this month goes out, the lambs of the flock may be weaned. They are put on aftermath of clover, or other good keeping, while the ewes are for a few days put on the barest pastures.

This is the ordinary time for dipping sheep to destroy ticks, and both ewes and lambs are the better for it: the subject was referred to last month betimes. Ewes should be kept from their lambs, if not already weaned, for a day after being dipped; and their udders should be wiped and cleansed with a cloth.

We add the following to the remarks made last month on sheep-shearing. The general price of sheep-shearing in Sussex is 10s. a

hundred, and four quarts of beer per man. Half-a-crown a day, with beer, is paid in addition to a man who winds the wool for eight or ten shearers; and there are two men employed to catch and carry the sheep to the shearers, who have 2s. a day apiece. Each shearer is supposed to cut forty sheep a day, and for 320 sheep the cost would be—

	£	s.	d.
10s. per 100, with beer	1	18	0
Wool winder	0	3	3
Two men to catch	0	5	6
320 sheep, at 2s. 11d. a score	£2	6	9

This is the cost in the case of the small Sussex Southdown breed. In Gloucestershire the cost of shearing the large Cotswold sheep will be nearer 5s. a score than 3s., which is thus the cost in Sussex.

The following is a report, in illustration of the contrast which climate imposes in the management of sheep, from the Lammermoor Sheep Farm, already quoted in our pages:—

July 23.—Until the beginning of this month it can scarcely be said that we have had summer weather. Frosty nights, and cold withering winds during the day, were the marked features in the register for May and June. Under such adverse circumstances vegetation has made very slow progress, and there has been a greater want of grass on our hills during the months of May and June than has been the case for some years past. The effect of this on sheep stock is very apparent, more especially on lambs, which have neither the condition nor the blooming skin they had last year. For three weeks, however, we have had genuine summer weather, which has had the effect of magic on the pastures and everything else. We finished the shearing of sheep on the 13th, being fully a week later than usual. This arises partly from the cold weather, and partly from the want of condition having considerably retarded the growth of the wool. When washed, the sheep are driven three or four times through a deep pool, about eighteen yards broad, and clipped three days afterwards. Whenever a lot is clipped, they are driven once through the washing pool to wash away any dirt that may have adhered to them during the operation. This practice is not a common one, but has long been followed on this farm, and was first adopted on account of the frequent deaths that occurred immediately after clipping. Two years ago it was discontinued for one season, and the consequence was that a considerable number died. Since then it has been regularly done, and there has been no loss. Now that the grass is growing and the ewes want their fleeces, we expect the lambs to improve rapidly. The principal business of the shepherds at this season is to keep them clear of maggots, which in the

present warm, moist weather, are very troublesome. The lambs will be weaned about the middle of August.

Hogs.—During this month the stock of swine may be supported on clover, lucerne, vetches, &c.; for sows that have pigs, and for weaned pigs, more liberal management is needed; and Mr. Stearn, p. 250, may be read with advantage. This is not a month of difficulty for this animal; and the young farmer should take care that his dairy wash is accumulating in his cisterns for sows and weaned pigs, for a time when they may want it more than they do at present.

VIII.—THE USE OF LEISURE TIME.

It is during this month, between hay and corn harvests, that the most convenient time occurs for a holiday. It is now that the annual meetings of our great agricultural societies occur; and as the first edition of this book says—

If the young farmer has any friend, or confidential bailiff, that he can trust his farm to for ten days or a fortnight, let him now take his summer tour, to view farms in well-cultivated counties, and to introduce himself to the conversation of his intelligent brethren, from whom he will be sure to learn something useful. He cannot do better than be present at one of the public meetings of this month, as he will there meet with able cultivators from every part of the kingdom, and may learn where best to direct his steps, whatever may be his object: and this, let me remark, is no inconsiderable proof of the utility of those meetings.

Were I to name one circumstance which has, in the last twenty years, advanced the husbandry of this country more than any other, I should fix on the practice of farmers *taking their nags* (to use an expression of Bakewell) *to see what other people are doing*. Men who confine their whole lives to one spot or vicinity, necessarily contract a too limited range of thought. Their ideas flow so much in the same channel, and dwell on the same objects, that new ones, however useful, make too faint an impression: nor can they know what is doing by the best farmers, on soils perhaps exactly similar to their own. To take a ride for a fortnight through four or five hundred miles of country, with an eye scrutinizing everything they see, and calling upon noted farmers to make inquiries about such objects as appear interesting, must necessarily give a new movement to their minds, a new spring to thought, and remove many prejudices. Two such journeys should be taken in a year—the summer one to illustrate the results of your practice, the winter one to explain the winter management of live stock, the important objects of the farm-yard, fattening beasts, sheep-feeding in many branches, winter irrigation, and many other objects which are interesting. A farmer may take such a ride at the expense of as many

guineas as he is out days, and he will not find this money the most unproductive that he expends.

Now also is the time for giving the labouring men a day's holiday, and a useful, wholesome thing it is to let the workers of the farm have a share in the enjoyments which a leisure time of year enables them to take. The following sentence, written by Mr. Caird, from Baldoon Mains, in Galloway, many years ago, will always well deserve perusal at this season of the year:—"I may mention that the men have been getting a day's holiday, and a beautiful day it fortunately was, as by the kind arrangements of our steam shipping company all the ploughmen and tradesmen of the country, with their wives and sweethearts, have an opportunity afforded them for a shilling each of taking a pleasure sail to the Isle of Man and back again, of which it is to be hoped very many will avail themselves. All the farmers who can look beyond their noses have given their men a day's leave of absence, convinced that they will be well repaid by the stock of good nature which the men will lay in during the pleasure trip."

AUGUST.

The average weather of August at a number of English stations is given in our usual monthly meteorological table on next page.

The ordinary operations of the farm include and are almost confined to harvest work of all kinds—but we shall discuss also, (1) *the diseases of grain crops*; (2) *the laying out land for irrigation*; (3) *harvest operations*; (4) *crop cultivation*; (5) *management of live stock*.

I.—DISEASES OF GRAIN CROPS.

In the *Gardeners' Chronicle* of 1856 and 1857 a series of papers appeared, by the Rev. M. J. Berkeley, upon the various blights and other diseases to which plants are liable. I take the liberty of extracting and condensing from the series two or three passages relating to the diseases of wheat and other grain, the effects of which appear at harvest time.*

Smut, or Dust Brand.—The genus of parasitic fungi, known under the name *Ustilago*, contains some of the most formidable and

* The reader may also consult a paper on the subject by the late Rev. Professor Henslow in the second volume of the *English Agricultural Society's Journal*.

THE WEATHER OF AUGUST.

LOCALITY.	AUTHORITY.	Mean tempe- rature.	Lowest mean tempe- rature.	Highest mean tempe- rature.	Greatest heat.	Lowest maxi- mum heat.	Highest mini- mum cold.	Greatest cold.	Average amount of rain.			Average number of rainy days.			No. of years' obser- vations.
									inches.	Smallest amount of rain.	Greatest amount of rain.	inches.	Smallest number of rainy days.	Greatest number of rainy days.	
Guernsey.....	Dr. Hostins, F.R.S.	61.7	56.0	62.9	79.0	66.0	56.0	51.0	2.2	0.5	6.0	10	4	24	12
Helston	Mr. M. P. Moyle...	66.9	58.8	67.1	88.0	69.0	51.0	40.0	2.8	1.0	5.2	13	6	26	16
Exeter.....	Mr. W. H. Ellis.....	62.2	57.6	64.8	91.0	69.7	49.2	44.6	2.1	0.2	3.6	17	11	28	7
Ventnor, I. of Wight	Dr. Martin	64.9	58.7	66.6	82.0	69.0	55.0	45.0	2.6	0.7	5.3	12	8	21	22
Worthing, Sussex	Dr. Barker	61.2	57.8	63.5	81.1	69.5	51.2	48.7	2.5	0.5	4.4	11	5	20	9
Clifton near Bristol	Mr. W. Burder, FRAS	60.2	56.9	63.2	91.4	69.7	47.9	39.4	3.6	1.3	5.7	15	7	23	8
London Royal Observatory ..	{ The Astronomer Royal, F.R.S. }	60.5	55.4	65.8	92.0	70.8	49.9	40.0	2.3	0.5	4.5	12	8	29	90
Bedford	Dr. Barker, F.R.A.S.	61.9	57.8	65.9	94.0	72.0	51.0	40.2	2.8	1.2	6.0	—	—	—	10
Lampeter, near Cardigan.....	Rev. Prof. Mat- thews, M.A. }	59.2	57.2	63.9	89.0	76.5	44.0	38.8	2.7	1.8	3.9	11	7	17	6
Norwich	Mr. W. Brooke, FRAS	60.4	55.9	64.4	89.0	70.0	54.0	41.0	2.7	1.0	4.8	13	6	20	21
Highfield-House Observatory ..	Mr. E. J. Lowe, F.R.A.S. }	60.3	54.6	65.3	92.5	73.0	50.0	34.2	3.2	1.0	6.3	17	10	31	51
Oxford Observatory	Rev. R. Main, F.R.S.	60.1	56.9	63.0	83.0	68.5	48.7	36.7	2.7	0.9	4.5	13	8	20	34
Grantham	Mr. J. Jeans, F.R.A.S	60.1	56.3	63.3	85.6	68.6	48.7	40.0	3.1	1.4	4.8	14	10	24	10
Hawarden, Chester	Dr. Moffat, F.R.A.S.	58.6	53.4	62.3	84.5	60.7	49.5	42.0	3.0	1.6	5.0	15	9	22	11
Manchester.....	Mr. G. Vernon FRAS	—	—	—	88.2	—	—	42.0	3.9	1.3	6.0	17	8	30	12
Leeds	Mr. H. Denny	60.8	55.0	63.0	97.0	74.0	49.0	42.0	2.6	1.4	4.8	15	10	25	10
York	Mr. Ford	59.1	55.8	63.0	84.0	68.5	55.0	36.0	2.9	1.1	6.6	13	8	21	20
Scarborough	Mr. B. Cooke	58.5	54.6	60.2	81.0	64.0	51.0	43.0	2.5	1.8	4.2	9	6	13	6
Isle of Man	Mr. J. Burman, FRAS	57.8	54.8	60.2	82.1	69.0	46.0	40.0	2.7	1.5	4.9	12	9	20	7
Durham Observry	Mr. A. Marth, FRAS	56.9	54.2	59.8	80.1	66.4	49.0	34.0	2.6	0.6	4.9	13	4	23	14
North Shields.....	Mr. R. Spencer	57.7	54.3	60.5	79.0	65.7	49.0	39.0	3.6	1.0	7.9	18	12	28	16
Silloth	Rv. F. Bedford, FRAS	58.4	55.5	60.2	82.9	73.2	44.8	40.2	3.8	3.4	4.4	14	9	20	3

* Observations at Highfield House on temperature extend over fifty years, and at the Royal Observatory over ninety years.

destructive parasites which affect a variety of plants of very different characters, but more especially those grasses which are cultivated for the nutriment of man and of those domestic animals which form so important a part of his food. They differ considerably in colour and character, varying from purple or lilac to violet and olive brown. Those species which affect cereals are all of a dingy tint and of very simple structure.

All our cereals are more or less subject to be attacked, wheat forming no exception, though smutty wheat is comparatively rare. Barley and oats are subject to it, but seldom in such quantity as to attract notice.

Though smut is highly destructive where it abounds, it is not so injurious to the harvested grain as bunt, because the spores are in great measure dispersed before the grain is ripe, which is not the case with bunt, the spores of which are frequently not set free till it is broken up by the flail or threshing machine; added to which it is entirely void of the disgusting fish-like odour which is so offensive in the bunt.

The question of most interest to the farmer is how he may get rid of the plague. The remedies are, undoubtedly, the same as those of which we shall have to speak in reference to bunt, but they are not so efficacious, because the seed is not so apt to be impregnated by the spores as bunted wheat. The greater part is dispersed at an early period, and falls to the ground, where it is ready to attack the sprouting seed. We have, however, failed in obtaining smutty grain from seed purposely impregnated, which is scarcely ever the case with bunt.

Rust.—Under the genus *Uredo* are comprehended numerous parasitic fungi, which attack plants belonging to almost every natural order. Some of them are nearly harmless, while many are extremely mischievous. Their spores are of different colours, yellow, orange, white, brown, &c., and their structure very various.

The white rust is familiar to every one from its prevalence on cabbages, shepherd's purse, and various other crucifers. The most important, however, of the species of rust is that which attacks the spikes and leaves of corn. We must, however, first distinguish between *U. linearis* and *U. rubigo-vera*, the former being simply the young state of *Puccinia graminis* (wheat mildew). As the two plants frequently grow together, it was at one time thought that *U. rubigo-vera* was also a mere state of the wheat mildew. As long as the rust is confined to the leaves it is of little consequence, especially if the growth of the plant be vigorous. The leaves at length flag, and the effect seems merely to check undue luxuriance; but if the spikelets and germen are affected, a circumstance which takes place at a later period of growth, the effects are disastrous. The matter which was intended to nourish the

germen is diverted, and the grain, which was at first swollen, becomes in consequence meagre and shrivelled. In red wheat the disease is scarcely ever prevalent, but in the white wheats it is so virulent that in countries which do not suit them it is often almost impossible to secure seed. In all these cases so many of the spores fall to the ground that no system of washing or steeping is effectual. The only remedy is to avoid growing those especial varieties which are most subject to the complaint, a remedy which is very easy where red wheats form the staple of the crop, but where white wheats are most suitable to the soil we fear that there is no known remedy. The rotation of crops is, however, greatly in favour of the cultivator, for rust is far less common on other cereals than on wheat, though unhappily it occurs on many grasses, by which the plague is propagated.

Bunt.—The effect of bunt on corn is like that of smut, to convert the tissues into, or rather to replace them by, a mass of dust-like spores. In smut, however, these are soon dispersed; in bunt from the stronger texture of the walls they are in general retained and are not broken up till the flail is put to the harvest. In smut, though dirty and disagreeable, there is no offensive smell; in bunt the greasy spores have an odour like that of stale fish.

No parasite is more injurious to cereals than bunt, but happily it is one of the few affections of plants which is readily controlled, insomuch that the proportion of bunted ears in a crop is a tolerably sure indication of the degree of skill or care which belongs to the cultivator. Each farmer has his own remedy. Simple immersion of the seed in water alone is of considerable service from washing off the spores of the parasite, but if the crop is to be completely free, some addition must be made to destroy those which still adhere to the grain. Corrosive sublimate, arsenic, and blue vitriol are employed for this purpose, but besides the danger attendant on the use of such poisonous substances, the two former are apt to act upon the seed itself, if from any delay consequent on bad weather it is not sown at once. Blue vitriol, unless prepared of great strength, has not this bad quality. A very simple and effectual mode of treatment is to mix quicklime and water together, and apply it hot to the wheat placed in small convenient heaps, so that every seed may be covered with the mixture while still at a high temperature. This plan is called *pudding*. The most efficacious plan, however, though one which is little if at all practised in this country, is to make a strong solution of Glauber's salt (sulphate of soda). The wheat is then steeped in the solution, and dried off with powdered quicklime, the effect of which is to decompose the sulphate of soda, the sulphuric acid combining with the lime to make sulphate of lime or gypsum, while the caustic soda is left behind to destroy the spores of the parasite (see Calendar for September and October).

It does not appear that wheat much mixed with bunt is unwholesome. The colour of the bread made from it is injured, and the nutritive qualities probably impaired, but though extensively consumed at times by farmers and labourers, we have never heard that it is injurious to health, nor is it as disagreeable to the taste as might be conceived from the nauseous smell of the raw fungus. Bunted wheat is bought up principally by the gingerbread makers, for which purpose the dark colour is of no consequence.

Mildew.—The mode and time of introduction of the mycelium of the parasitic fungus *Puccinia* into the mother plant has not at present been observed, nor the stages of growth which precede the appearance of the developed fungus upon the leaves or stem. It is not, however, probable that the spores adhere like those of bunt to the grain, for they are not easily removed from their place, and if they did adhere they would be destroyed by the usual dressing in the same way as bunt, which is not the case. In any case they do not germinate till spring. Wheat mildew is one of the most formidable plagues against which the agriculturist has to contend, and unfortunately one against which he has no remedy. The very cultivation which is most conducive to a large produce in good seasons, is in unfavourable seasons productive of mildew. In bad mildew years the worst crops often suffer the least because they are less heavy. A pamphlet was addressed by the late Mr. Tycho Wing to the tenants of the Duke of Bedford, at Thorney, calling upon them to clear out the ditches with which their fields are bordered, as the reed constantly harboured a quantity of *puccinia*, which he believed with good reason to be the same species with that of wheat. The advice was undoubtedly good, but unfortunately the spores of *puccinia* when once separated are capable of being blown about by every breeze. In fact, spores of such plants occur in the dust of the trade winds, as observed by Ehrenberg. If, however, they germinate while still attached, the spores of the second order are still more capable of being wafted everywhere. For the present, therefore, the farmer must be content to reckon mildew as one of the unfavourable circumstances which he must take into calculation in estimating the average annual value of land. In such case he at least will not be the sufferer.

The Wheat Midge (*Cecidomyia tritici*).—This little fly has a right to be considered a parasite, if it be true, which seems to be the case, that it lives upon the juices of the young germen, and not upon the pollen grains as has sometimes been supposed, probably from the bright colour of the larvæ, which I have conceived to be derived sometimes, when peculiarly deep, in part from the spores of *Uredo rubigo-vera*, which is so frequent an inhabitant of the same glumes as the larvæ. However this may be, it is too certain that the wheat midge is at times one of the most formidable enemies

of the farmer, and there are probably very few years when the crop does not suffer in some appreciable measure from its ravages. The perfect insect appears about June, being derived partly from larvæ which descended into the earth the previous year, and partly from cocoons spun in the chaff and carried home with the crop, for though it was once conjectured that those larvæ only which were attacked by ichneumons entered into the soil, later observations seem to prove that this is not the case; but that according to circumstances, strange as it may seem at first sight, the larvæ adopt one or other of the above-mentioned habits. The young larvæ are at first lemon-coloured, and spring from eggs deposited between the glumes. As they increase in size their colour becomes more intense, and as they are found amongst the glumes long after the pollen has vanished, it seems certain that the abortion of the germens which constantly accompanies their presence is due, not to the destruction of the pollen, but to the actual exhaustion of their juices. Those germens only prove abortive which are formed within the scales which are infested by larvæ, and these occur frequently in enormous quantities, thirty or more individuals existing at once in a single flower.

Various estimates have been made of the damage done by these insects. It is evident, however, that this must be in direct proportion to the number of the mother flies, and as in the case of so many insects, in one season they are multitudinous, in others comparatively rare. In Scotland and North America the evil reaches perhaps its maximum, but it is often sufficiently great in other parts to attract the notice of farmers, who usually call the ears "blighted" without being aware of the cause. Where this is ascertained, the cultivator will be wise to take some precautions. He will not be able perhaps to contend against those individuals which enter into the soil, but by simply letting the chaff when the grain is winnowed fall on a piece of wire gauze placed before the machine, as suggested by Professor Henslow, he will be able to destroy myriads (*Gardeners' Chronicle*, 1841, p. 52), and several species of ichneumon will then assist him in thinning those which he has failed to destroy.

Ear Cockle, or Peppercorn.—The disease in wheat locally known under the names above given is by no means universal. It seems to be more prevalent in the east and south of England than in other districts. I have never met with a single specimen in the midland counties. In Suffolk it is sometimes abundant and forms a considerable portion of the tail wheat, or that which is separated in dressing from that of the best quality, which is in general the only sample which reaches the market, the tail wheat being consumed by the farmer's household. In those ears which are affected, the glumes are separated from each other and are spread out, the awn is

twisted, and the grain, which has acquired a globular form and has assumed first a dark green, then a deep olive or black tint, becomes exposed, so that the affected ears are readily distinguished. When divided, the grain is found to contain no meal; but in its stead a white powder, which, under the microscope, consists of an enormous number of minute eel-like worms, a few of which attain a far larger size than the rest, and produce eggs from which new individuals are hatched in a few days. Before the young worm quits the egg it may be seen curled up within its walls. The wheat when ground is troublesome to the miller, as the little worms block up the apertures of the bolting cloth. If clean grain and ear cockle are sown together, the young plant remains healthy for a time; but the vibrios soon penetrate into the healthy seedling, through the tissues of which they work their way into the germens, and eventually destroy all the meal, or at least take its place. Wheat is in general the only cereal affected, but oats, barley, and rye may be inoculated by sowing them with ear cockle, though with much greater difficulty than wheat. One of the most curious points about the wheat vibrio is the great tenacity of life with which these little worms are endowed. Ear cockle which has been six years or more in the herbarium, when moistened, yields a multitude of living worms, though at first they seemed under the microscope perfectly devoid of life, and the same specimen may be revived several times in succession on the reapplication of moisture. As the ear cockle when steeped with other wheat soon sinks to the bottom, mere skimming is not sufficient to get rid of it entirely. It was suggested by Prof. Henslow that heat might be employed, but as it appears that wheat ceases to germinate at precisely the same temperature, 148° F., which is fatal to the vibrio, there is little hope from kiln drying or from the application of quicklime in boiling water, a method which is practised in many districts against bunt. Dilute sulphuric acid in the proportion of 1 to 200 destroys the vibrio effectually, and it may therefore afford a hopeful remedy. This however must be made the subject of direct experiment, and possibly rewinnowing the seed corn may be a sufficient safeguard without further and more troublesome and expensive processes. Vibrio has, I believe, never been found in this country except on cereals.

The above passages, descriptive of the diseases to which the wheat crop more especially is liable are, let me repeat, condensed from Mr. Berkeley's papers on the subject in the *Gardeners' Chronicle*.

II.—IRRIGATION.

In the original edition of this work some remarks were given, which are here transcribed, on the proper way to set about the sys-

tematic irrigation of an estate. This may be done at any leisure occasion of the year, and is especially fit for being done during the summer season, when the supply of river-water is at a minimum, and is not likely, therefore, to mislead the sanguine man.

In situations that possess plenty of water, with meadows for receiving it, they may be formed at any time in the year except in severe frosts; but when there is any doubt of the quantity of water being sufficient, the safer way (if any large expenses are in contemplation) is to begin the work in a season when the undertaker is not liable to be much deceived; this *may* be the case in any month, if the preceding period has been remarkably wet: allowance must, however, be made for any such accidental circumstance; and it will be a good precaution not to lay out any large extent of meadow till some experience had been had that the quantity of water is sufficient for the meditated work. As this is (warping alone excepted) the greatest of all improvements, it is deserving of the greatest consideration and study of the water and land before a beginning is made. I should recommend, in the first instance, the employment of a professed irrigator, could the young farmer possess knowledge enough to ascertain the skill of such a man; but I really think a man may just as well trust to himself, with the assistance of books, as to put any faith in men who are reputed skilful only in proportion to the ignorance of those who employ them. If the following observations are carefully attended to, they will, I trust, enable any man to operate for himself in most of the cases that can occur, and with a certain degree of sagacity in all.

1st. The great benefit to be derived from power to take water from a river, stream, or lake, &c., will much depend on taking the first level from the highest spot on the water to which the operator's property or farm extends. If he is a landlord, he must, if necessary, purchase of tenants liberty to run his grand carrier through their farms (the property of the water being retained to himself) wherever the level may point out. He may, indeed, have to purchase a right to the water at the point from which he starts.

2nd. Having assured himself of his right to the water, and of his power to carry it through the intervening land, let him repair with his spirit-level and attendant to the highest spot where the stream enters his property or farm, where he has the property on both sides, and where he can erect works across the stream in order to divert the whole, or any part of the water, into a new channel; and let him begin to take the level from the surface of the water, supposing it pent to the highest by such works.

3rd. He is to level from that spot, following the dead level, and at every three or four hundred yards stake it out doubly, one stake on the dead level, and another near it, descending from the dead level so many inches as an allowance to give the water a current:

two inches in a mile will move it, but twelve to twenty should be allowed, in order that the current may be sufficient.

4th. If both sides of the stream be his own farm or property, let him go back whence he started at his highest spot, and do exactly the same on the other side of the vale, staking out his level there also.

5th. Having proceeded thus far, let him carefully examine all the land on both sides the river below his lines of levelling, for he has the power of watering all or any part of it, if the stream be sufficient. The breadth will depend on the degree of the declivity between his first and last station, and on the diverging and fall of the higher grounds or hills; but in every case he will find a vastly greater quantity of land than he had any conception of before he took the level. Mr. Bakewell lent his irrigator to a friend, in order to ascertain whether he could water the church meadow; and on the level being taken, it proved that the water might be carried over the church steeple, had the land been high enough to receive it.

6th. When the levels are taken, in examining all the lands below them, the main point (in which errors are perpetually made) is to determine where to begin. In making his estimation, the operator is to attend to the following circumstances:—

(a.) The grand carriers on the levels first taken should be large enough to take *the whole stream* on either side the vale at pleasure; but if the lands on one side are more favourable for watering than on the other, let that carrier be executed first. If the most favourable land to work upon on such side be at a great distance from the original spot where the water is first taken, and there be not water for the whole below the level on one side of the river, then he must compare the expense of the carrier with the superiority of the profit of watering the most favourable fields, rather than others nearer not offering in themselves an equal advantage. In most cases, the benefit of watering at pleasure is greater than the expense of making the carrier. And in this point there is also another consideration of great moment: though the river may not afford plenty of water in summer, or very dry years, yet it may abound in winter, and watering at that season alone is well worth the expense of all the necessary works in most cases: and this consideration should influence him rather to extend his carrier, than, by shortening it, be forced to water fields not so well adapted as others at a greater distance: probably the winter watering may go on through the whole line.

(b.) When such a level is taken as I have described, there is often found below it a great variety of soils and circumstances; usually a low flat range of meadows, perhaps wet and boggy, by the side of the old river, and adjoining and above them slopes of pasture, and arable, it may be dry, gravelly, sandy fields on various

angles of declivity : bogs, ling moors, and, in short, every sort of soil and land, so that the irrigator may choose what he pleases to work upon. Here he must be instructed that the lands usually chosen for the first operations are just those that ought to be the last, viz., the low flat meadows by the river. These are often improveable to a very high degree, by draining and manuring with sand, gravel, earth, chalk, marl, &c., but they are by far the most expensive to irrigate, and when done, unless very well executed indeed, yield the worst hay. They are best watered, and, in many cases, only to be watered advantageously, by ploughing them into broad and highly-arched ridges ; the delivering trenches to be on their crowns, and the drains in their furrows. But the profit of irrigating dry slopes of sand and gravel, &c., and poor dry ling moors, is immense ; the expense is comparatively trifling, and the improvement beyond conception ; such lands may be raised from 2s. to 3s. an acre to 40s. or 50s., while the flat meadows may be 20s. before the undertaking begins, and may not, when ended, be worth more than the others, though effected at ten times the expense. I once found a friend in the full speculation of watering some downs which were worth 25s. an acre, and just ready to set a man to work who ought to have known better. I thought, by my eye, that the water (the quantity very limited) might be better employed on some dry arable land above the meadows, but further down the vale. I took the levels, and found it as I conjectured : the plan was adopted, and I have since heard that the undertaking was remarkably profitable. Our operator should choose for his first works those fields the state or value of which is the most promising for working a great improvement, and these will be the dry arable slopes, or poor dry pastures. And if he has a choice, let him begin with one which joins his carrier, and mark the lower spot, side, or corner of it where the water may best have its issue, having been worked over its surface ; and at that spot taking his station, let him examine what field is so situated as to take the water next. If the declivity is at all steep, any may do ; but if gentle, it may be necessary to conduct it diagonally to some distance before a field is found low enough to receive it ; for let our operator have it in his attention, that before he meddles with any other work, he is to conduct the water thus first taken to its final exit into the bed of the river, whence it can no more be taken by him. In some cases, it might be more profitable immediately to water other fields nearer the carrier ; but as the water used in the first field would in that case run to waste before it arrived at the river (especially if the tract to be watered be of any extent), and as it is beneficial to plan what is to be done with all water taken, in its whole course from the carrier to the river's bed, it is much better to finish with it before a fresh work is opened.

On gentle slopes of country this plan will generally make it

necessary to conduct the water by a line of fields diagonally across the slope of the country.

Having watered one range of fields diagonally across the space between the grand carrier and the river's bed, he may then return and work a second range, and so on till he has acquired the power of conducting the water to any field at pleasure.

This is the plan recommended for the systematic treatment of the whole or greater part of an estate. It is, however, generally the case that only a field or two conveniently near the water-supply are to be irrigated. The grand principle which is to govern such work is, to bring water on as plentiful as may be, and let it run off quickly—*nimbly*, in irrigating language: if it stagnate, it does mischief, and if it only creeps sluggishly, much less good than a better course would have enabled it to effect. All spaces that are level, or nearly level, should be ploughed into lands or ridges eleven yards wide and raised, if water be plentiful, three feet higher on the crown than in the furrow, in this form, and of course these ridges must be laid out by the spirit-level, so that the delivering trenches on their crowns may be able to take water from the larger carriers which lead along one headland; and that the furrow-drains may convey the water away to the receiving ditch provided for that purpose. These trenches are to be so exactly cut that they will overflow through the whole length equally at the same time, for which purpose they lessen in breadth as they advance. The furrows, on the other hand, between these ridges, commence with hardly any depth or width, but widen and deepen as they run, until at their junction with the main drain they are as wide as the feeding-trenches at the summit of the ridge are at their commencement. Along, or rather *across* the upper ends of these ridges, the main carrier runs, and has a stop in it at each feeding-trench, by which a certain quantity of its water is diverted for the use of that particular ridge or land. Across the other ends of these lands, on the lower side of the field, lies the main drain by which all the water is carried out of the field. On the rapidity of movement in the water depends the efficacy of the irrigation. And the effect is greater the more perfect the drainage whether of the surface or the subsoil.

The utility of catch meadows on hill sides has been already referred to at page 41; and we add here from an early volume of the *English Agricultural Society's Journal*, an account of Mr Roals' formation and management of such meadows at Brendon Farm, Somersetshire. He says:—

"At Lady-day, 1816, I began to farm three hundred acres of land on Brendon Hill, the property of the Earl of Carnarvon, the elevation of which is one thousand feet above the sea; about two hundred acres were then covered with heath, sixty with fern, and the remainder with peat and moss. Not having hay to give me

horses, I began to turn attention to procure some. The first course I took was to take the level from all the springs, and then to ascertain how many acres I had under that level that I could carry the water over; and when I found how much land I could irrigate, I began to cultivate my intended meadow, which was done by paring and burning, and, after spreading the ashes, to break up and work the land to the depth of from twelve to fifteen inches with Finlayson's harrow, by stirring the subsoil, but not to bring it to the surface; after working many times over in this way, I got the surface as even as I thought necessary; it was then manured with sixty bushels of lime an acre, and sown with turnips, which were fed off on the land. After the turnips the land was again worked with the harrow, rolled and made fine, and in April was sown with grass seed, harrowed in and rolled. The grass came up well, and was stocked on the 1st of July following with seven sheep to the acre, which it kept in good condition until the 1st of November, when it was again rolled, and the water gutters made to take the water that was drained from the springs above. I set out the watering gutters by the level, giving them one inch fall in every ten feet. They were cut nine inches wide and three inches deep. If the land has a gentle slope, the gutters may be put sixty feet from each other; but if it be very steep, and there is a good flow of water, they may be put seventy or eighty feet apart. When I find the water sink too fast into the land, I spread fine earth or road scrapings over the surface in order to fill it up, that the water may pass over to the next catch-gutter. In this way I made my first fourteen acres, which took five years to complete. In the same manner I have from time to time drained all the wet land on the farm, and have now thirty acres of meadow, which yield a crop of hay from a ton to a ton and a half per acre annually.

"Where it is possible to carry water over dry land, it is best to do so; but the *bog itself* can be converted into water meadow. I have lately drained a deep peat bog by cutting drains in some parts of it to the depth of seven feet. This bog was ten acres; one-half of which is now watered. The way I manage to prevent the flooding water from getting down into the drains is as follows:—I first fill the bottom with flat stones set on their edge one foot; then a foot of stones broken small; on them a three-inch turf with the grass downwards, and well trodden in; on this turf I lay on puddle, which I bring within six inches of the surface. When this is done, I pare and burn, manure, and manage the peat in the same manner as I do the other land.

"The water gutters should be cut with the under edge sloping outwards, in order to let the water flow more freely over the land, and be less liable to be trodden in by cattle or horses passing over them. The water should never be suffered to remain in one place

over the grass more than two or three days at a time without being changed, nor be turned upon the land in order to remain there during frost; but should the frost set in while the water is on, by no means alter it until the frost is gone; for if the surface is exposed and the frost continues, it will most likely lift the land and kill the grass. After the hay is made I never stock the after-grass with anything but sheep, or cattle under two years old, feeding it down as close as possible by the 1st of November. I then clean the gutters and roll the land in order to begin watering as soon as the springs *begin* to break in the autumn. *November, February, and March* are the best months for watering.

"All the land on this farm was valued under an Inclosure Act in 1804 by the surveyor at 2s. an acre. What I have converted to meadow would now let for 25s., and is still improving. The soil on this farm is part peat and bog, and brown loam resting on gravel, and a soft slaty rock. The fern grows in the brown loam, which on our moors is by far the best land for water meadows.

"The sides of the mountains in the north of England and Wales might be converted to catch meadows in the same way that I have done mine, provided the water is of good quality and the land can be made porous to let the water filter gently down. I have never found turning water over old pasture do much good, as the grass that comes up is coarse and thin, and the hay, if mown, is not of good quality. If, therefore, old pasture is intended for meadow, it will answer best to break it up first, work it clean, manure it well, and seed it down with those grass seeds that are most congenial for water meadows.

"The first Year's Expense per Acre.

	£	s.	d.
"Paring and burning	1	0	0
Spreading ashes	0	1	6
Working land with Finlayson's harrow, 4 horses	1	5	0
Harrowing and rolling	0	5	0
60 bushels of lime and carriage	2	5	0
Slaking and spreading lime	0	3	0
Turnip seed	0	2	0
Drill and harrowing in seed	0	3	0
Hoeing turnips	0	5	0
	5	9	6
Value of turnips	3	3	0
First year's outlay	£2	6	6

Second Year.

Brought forward . . .	£2	6	6
Cultivating after turnips . . .	0	10	0
1 bushel of rye-grass seed . . .	0	5	0
12 lbs. red and white clover, 10d. . .	0	10	0
6 lbs. rib-grass seed, 4d. . .	0	2	0
Sowing and harrowing in grass seeds . . .	0	2	6
Making water gutters . . .	0	10	0
2 years' rent of land . . .	0	15	0

£5 1 0

To keep of 7 sheep from 1st July to the 1st November, 16 weeks, at 8s. each . . .	2	16	0
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£2 5 0

After-grass	0	5	0
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Total expense of converting a waste }
mountain-side into water-meadow } £2 0 0

"The reason I did not plough the land after the ashes were spread, was that I wished to keep the vegetable matter that was on or near the surface from getting down to mix with the subsoil."

On this Mr. Pusey added the following suggestive comment:—

"I have known Mr. Roals' farm for many years. It stands alone on the summit of the wild Exmoor range of mountain land. If any one asserted that, for a trifling outlay, he could enable heath-covered steeps to rival in produce and value the old grazing grounds of Northamptonshire, he would be regarded as a dreamer. But if any owner of moors will visit West Somerset or North Devon, he will ascertain the literal truth of the statement, as I did five years ago. All that is required is a streamlet trickling down the mountain side, or a torrent descending rapidly along the bottom of the glen. The profit of underdraining old arable land appears trifling when compared with the profit of thus forming catch-meadows, which, according to Mr. Roals, is more than one pound interest for two pounds invested. The two pages of this Prize Report, which state no more than Mr. Roals has himself done, contain a talisman, by which a mantle of luxuriant verdure might be spread over the mountain moors of Wales and Scotland, of Kerry and Connemara. If the plain means of improvement and employment are still neglected, it will be impossible not to tax the owners of those needless deserts with supineness; and difficult to deny that they hold in their hands more of this country's surface than they are able to manage for their own good or for the good of the community."

The effect of irrigation is to eradicate poor grasses and weeds from meadows, and to greatly increase the rapidity and productiveness of growth of good grass.

The abundance of produce from well-managed water-meadows, and the influence of irrigation on the composition of their grasses, are well illustrated by the following paragraphs:—

Mr. Squarrey, who gave a lecture on this subject at the Salisbury meeting of the Agricultural Society of England, said—I have myself, on a meadow of 13 acres, 3 roods, 20 poles, kept on the spring grass, in April and May, 277 couples thirty-three days, and eleven cows twenty-six days, with a little less than 10 lbs. of hay per day per cow, after which there was cut from the same meadow at least two tons of hay per acre, the aftermath being fed by cattle.

The following table, by Professor Buckman, represents the changes which took place in twelve species of the meadow-grasses under irrigation.

Table representing the Changes of Grasses under Irrigation.

Botanical Names.	Proportionals.		
	Before Irrigation.	After 2 years' Irrigation.	After 4 years' Irrigation.
<i>Alopecurus pratensis</i>	1	2	4
<i>Poa pratensis</i>	2	3	4
„ <i>trivialis</i>	1	2	1
<i>Briza media</i>	2	—	—
<i>Cynosurus cristatus</i>	2	1	—
<i>Aira cæspitosa</i>	1	—	—
<i>Agrostis stolonifera</i>	1	2	3
<i>Dactylis glomerata</i>	1	2	3
<i>Avena flavescens</i>	2	3	3
„ <i>pubescens</i>	1	1	1
<i>Hordeum pratense</i>	1	2	2
<i>Lolium perenne</i>	2	4	6

Some of the worthless grasses it will be seen disappeared altogether, while the more valuable sorts increased in the proportion in which they were present.

For those cases in which the land is laid out systematically in ridge and furrow for irrigation, it may be well that the experience of M. Keelhoff, a Belgian agriculturist, as described by Mr. Scott Burn, in the *Agricultural Gazette*, should be known. He recommends a deep digging in the ridge done with the spade—a carrying trench being left on the summit of the land, and a furrow being left to act as drain between the lands. This digging should be done before winter, and the grass seeds should be sown in the following spring, though it is sometimes not done till July or August.

The seed should be sown very thickly, so that the roots interlacing may speedily form a firm surface. Calm weather should be chosen for the sowing; the time being the months of April or May. If the seed is put in before the end of May, a cutting may be obtained towards the end of August; if delayed till July or August, the grasses acquire so little development that the frosts of winter generally injure them, greatly reducing the yield in the summer following. A light harrowing is used by some in order to cover the seed; but M. Keelhoff recommends, in preference, hand labour and a wooden rake. In light lands and in dry weather it is necessary before sowing the seed to allow the water to flow into the channels at the head of the ridge, in order to bring the soil to a proper degree of freshness, and to maintain it till the vegetation is vigorous. To this end the water is also admitted from the channels which carry off the water finally from the ridge to those channels placed at the base. The first season after sowing, all the moisture necessary to the due increase of vegetation is derived from the infiltration of the water through the soil, not by its shedding over the surface in the manner ultimately designed.

The quantity and kind of seed employed is a matter of the greatest importance. M. Keelhoff, who has tried nearly all the varieties of seed, found that those which gave the most vigorous vegetation were *Lolium perenne*, *Phleum pratense*, *Holcus lanatus*, *Poa pratensis*, *Alopecurus pratensis*, *Anthoxanthum odoratum*, *Cynosurus cristatus*, and Clovers. The following is nearly the mixture he employs:—

<i>Lolium perenne</i>		16 lbs.
<i>Phleum pratense</i>		6 „
<i>Alopecurus pratensis</i>		25 „
<i>Holcus lanatus</i>		25 „
<i>Cynosurus cristatus</i>		5 „
<i>Poa pratensis</i>		5 „
<i>Anthoxanthum odoratum</i>		10 „
Clovers		8 „
Per acre		100 lbs.

This mixture, says M. Keelhoff, may appear too heavy, but he has found that where less seed is used, the results are unfavourable. On this subject, for further information, the reader will consult our Index.

III.—HARVEST OPERATIONS.

These have, to some extent, been already alluded to (p. 363) in July. This month is, however, more properly the harvest month. All over South and Midland England August is the month of wheat

harvest. In the South it begins generally in July; in the North towards the end of August. In Scotland and Ireland September is the busiest harvest time. We shall refer to the several crops in the following succession, which is the order in which they generally ripen in this month:—*pease, winter beans, flax, rye, wheat, barley, oats, beans.*

Pease are generally fit to cut in July. If the crop is very great, they must be hooked; but if small, or only middling, mowing will be sufficient (p. 383). The stalks and leaves of pease being very succulent, they should be taken good care of in wet weather; the tufts, called wads, or heaps, should be turned, or they will receive damage. White pease should always be perfectly dry before they are housed, or they will sell but indifferently, as the brightness and plumpness of the grain are considered at market more than with hop-pease. The straw, also, if well harvested, is very good fodder for all sorts of cattle and for sheep; but if it receives much wet, or if the heaps are not turned, it can be used only to litter the farm-yard with. Pease, as soon as placed in ricks, must be thatched immediately; rain penetrates a pease rick easily.

Winter beans sown the previous October ripen towards the end of July, and are generally ready to cut before the wheat, or in the end of July. They are generally cut with the heavy hook, in the manner called “fagging,” or “bagging,” in which the workman, holding back the stalks with a stick, or merely with his left arm, levels a horizontal blow at the standing corn with the hook in his right, cutting close to the ground, and driving the cut stalks up against the standing crop a foot or more in depth, and, advancing across the ridge, cuts it back until a sheaf is ready for collection. He then gathers it together with his hook and left hand over his left foot as he walks backwards, and at length lifts it out on to a band laid for it before he commenced cutting it. This band in the case of beans should be made of straw, brought to the reaper in the field, and twisted in readiness as he proceeds by a woman, who does this, and ties as fast as the crop is cut. When the crop is very short and scanty, it is sometimes pulled instead of being cut. It is well to cut beans before they are dead and dry: the straw is of great use as fodder when it is cut while there is still sap in it.

Flax is pulled in July and August. The following instructions are given in an account of Belgian management, by Sir Donald Campbell, in the Highland Society's Transactions:—

When the flax begins to get yellow at the bottom of the stem, it is time to pull it, if very fine flax is desired, such as is made into thread for lace or fine cambric; but then the seed will be of little or no value. It is, therefore, generally left standing until the capsules which contain the seed are fully grown, and the seed formed. Every flax-grower judges for himself what is most profitable on the

whole. The pulling then begins, which is done carefully by small handfuls at a time. These are laid upon the ground to dry, two and two, obliquely across each other. Fine weather is essential to this part of the operation. Soon after this, they are collected in larger bundles, and placed with the root end on the ground, the bundles being slightly tied near the seed end; the other end is spread out, that the air may have access, and that the rain may not damage the flax. When sufficiently dry, they are tied more firmly in the middle, and stacked in long narrow stacks on the ground. These stacks are built as wide as the bundles are long, and about eight or nine feet high, and twenty to thirty feet long. If the field is extensive, several of these stacks are formed at regular distances they are carefully thatched at top, and the ends, which are perpendicular, are kept up by means of strong poles driven into the ground. This is the method adopted by those who defer the steeping till another season. Some carry the flax, as soon as it is dry, under a shed, and take off the seed by rippling, which is drawing the flax through an iron comb fixed in a block of wood; the capsules, which are too large to pass between the teeth of the comb, are thus broken off, and fall into a basket, or on a cloth placed below. Sometimes, if the capsules are brittle, the seed is beaten out by means of a flat wooden bat, like a small cricket-bat. The bundles are held by the root end, and the other end is laid on a board and turned round with the left hand, while the right hand with the bat breaks the capsules, and the linseed falls on a cloth below. The flax is then immediately steeped; but the most experienced flax-steepers defer this operation till the next season. In this case it is put into barns, and the seed is beaten out at leisure during the winter. When flax is housed, care must be taken that it is thoroughly dry; and if the seed is left on, which is an advantage to it, mice must be guarded against, for they are very fond of linseed, and would soon give a Flemish account of the produce.

Hemp is also pulled in the month of August. The leaves turning yellow, and the stalks white, are signs of its maturity: the male and female hemp are pulled together; indeed, when the crop is thick, it is impossible to separate them.

When it is all taken up, and bound in small bundles, with bands at each end, to such a bigness as you can grasp with both hands, it is conveyed to a pond of standing water (if a clay-pit the better), where it is laid bundle upon bundle, direct and across. This is termed a bed of hemp, and after it is piled to such a thickness as to answer the depth of the water, it is loaded with blocks and logs of wood, until all of it is totally immersed; after remaining in this state four or five days, as the weather shall direct, it is taken out, and carried to a field of aftermath, or of any other grass that is clean and free from cattle: the bundles being untied, it is spread

out thin, stalk by stalk ; in this state it must be turned every other day, especially in moist weather, lest the worms should injure it. Thus it remains for six weeks or more ; then it is gathered together, tied in large bundles, and kept dry, either in a house, or stacked and thatched, till December or January.

Hemp, when left for seed, is seldom water-retted, from the additional trouble and expense ; but it would be better if so done. It is generally stacked and covered during the winter, and is spread upon meadow land in January or February. If the season suit (particularly when covered with snow) it will come to a good colour, and make strong coarse cloths. It is much inferior to hemp pulled in proper time and water-retted.

Rye is ripe generally towards the end of July or beginning of August. The mode of harvesting it in no respect differs from that of wheat, which has now to be described.

Wheat, Oats, and Barley.—Under this head we must add to our notice of the reaping-machine given last month a short account of the most recent competition of reapers which has just taken place (August, 1861), under the auspices of the Agricultural Society of England at Leeds. Almost all the machines hitherto made and used in Great Britain have on different occasions received the prizes of the Agricultural Society. As each successively showed some especial improvement, and perhaps, also, as different judges undertook the investigation, so each in turn received the award of merit. Latterly the machine made by Messrs. Burgess and Key has generally been preferred, and as Mr. Shireff stated (p. 380), Bell's reaper, the only other self-delivering machine of any standing, has been considered too cumbrous and clumsy to compete with it. At the Leeds trial, however, having been greatly improved by Messrs. Crosskill, it received the first prize in its class ; the weight of the machine has been greatly reduced, and its draught also is so much lessened, that it was even easier to draw than its rival. Accordingly, the 20*l.* to be awarded by the judges of machines of this class were given, 14*l.* to Messrs. Crosskill for Bell's reaper, and 6*l.* to Burgess and Key for their McCormick. In the class of hand-delivering machines, the machine of Messrs. Picksley and Sims (Leigh, near Manchester) received 6*l.*, and that of Messrs. Cuthbert (Bedale) received 4*l.* ; the difference between them being one of draught, the former machine requiring less labour from the horses. The machines professing to do both reaping and mowing did not execute sufficiently good work to deserve the Society's prize, which accordingly was not awarded.

It may be added that since the Leeds trial a self-acting machine, delivering the corn in sheaves on one side of its track, has been patented by Mr. Samuelson, of Banbury, of whose performance a

very good account has been given by Mr. Chadwin, of Tollard Royal, near Salisbury.

The use of the reaping-machine has been already described. When, on the other hand, harvest work is done wholly by manual labour, the corn is either hand-reaped, "fagged," as in the case of beans, already described, or mowed and tied.

The processes of mowing and hand-reaping are well contrasted in the following report of the two by Mr. John Taylor, farm overseer at Corsietown, near Huntly. Mr. Taylor first considers the comparative merits of the implements in reference to the processes of binding, winning, carrying, stacking, and threshing the crop. In regard to binding, a man can bind and stook 1500 sheaves, cut by the scythe, in ten hours, as easily as he can bind 1200 sheaves cut with the sickle: the chief reason for the difference being in the circumstance of the binder to the mower having his work straight before him, without having to move from one ridge to another. It is allowed on all hands, as remarked by Mr. Taylor, that mown sheaves win one-fourth quicker than those cut with the sickle, though there is no perceptible difference in winning different lots of grain all cut with the sickle. As to carrying and stacking, mown sheaves are closer in the head than reaped sheaves, and on this account less grain is lost by shedding while being carted; and as a stack built of mown sheaves is more open, the grain and straw in it not only win sooner, but on that account may be carried with safety from the field in an imperfectly dry state. It is allowed that a stack of mown sheaves has a rougher appearance than one of sheaves cut with the sickle, and that it exposes a greater number of heads of grain to the weather and the depredations of birds; but this difficulty is easily overcome, as a man can dress a stack with a scythe-blade in an hour. It is admitted that hand-reaped sheaves are threshed about ten per cent. faster with the flail than mown ones; but as that implement is now in very limited use, and a good threshing-machine is equally effective and expeditious with sheaves cut in either way, this objection is of little importance. Another question of moment in using the sickle and scythe is the quantity of work performed by each, and its cost. The following are the results of Mr. Taylor's experience in the employment of seven harvest labourers connected with the operation of each implement, viz., with the scythe, two mowers, two gatherers, two binders, and one raker; and with the sickle, six reapers and one binder:—

	Of Wheat.			Of Oats or Barley.		
	A.	B.	P.	A.	B.	P.
By the Scythe	2	3	0	4	0	20
„ Smooth Sickle . .	1	1	18	2	2	10
„ Toothed Sickle . .	1	0	8	2	0	10

From these results, the advantage from the use of the scythe is obvious. According to the statement given by Mr. Taylor, it appears that the cost of mowing is about 4s. per acre—a sum considerably less than the expense incurred by either kind of sickle.

Probably most of the hand-cut wheat in this country is now done by the fagging-hook, which has the advantage of greater rapidity than the sickle, while the sheaves are at the same time looser, and more easily won. Of the merits of mowing, the following account is given by a Ross-shire correspondent, who describes the harvesting of a light crop in a good season. How much later harvest is there than in the southern counties is plain from the opening sentence of the paragraph:—

On the 14th of September (1859), we completed one of the finest harvests we have ever had. There was little interruption from bad weather from beginning to end. Take the following as a specimen of what can be done by the scythe, with a light crop, and having all the hands well fitted for the different parts of the work:—"On Saturday, the 20th of August, we commenced cutting 140 acres of wheat, oats, and barley, with six scythes. In twelve days of working time the whole 140 acres were gone over—each man having cut little less than two acres per day. There were employed in all six scythemen, six women for gathering, six men for binding, and three boys for raking. The six scythemen and two of the rakers were engaged for the half year; all the others were engaged for the harvest. A few of the hands were discharged when the cutting was completed; the others were retained to assist in carting home and in stacking the crop. This operation occupied seven additional days, on which days some fifty-five stacks were carted to the stackyard. The scythemen and two of the rakers being, as I have already said, half-year servants, were not, of course, then paid. The binders had from 2s. 3d. to 2s. 6d., and the women and boys 1s. 9d. per day. The whole outlay amounted to 20l., the cutting, reaping, binding, raking, leading, and stacking being about 2s. 11d. per imperial acre. We would have greatly preferred a more costly harvest, with a better filled stackyard. Wheat bulked less than usual; barley considerably less; and of oats there is less than half the usual bulk."

In the Southern counties the usual method is to tie the wheat in sheaves, as it is reaped, fagged, mown, or cut by the machine, and place them in stooks the same day, about five sheaves on each side. It is well to place the stooks in rows as far apart as possible, to enable stubble cultivation at once to be proceeded with.

In the North they place sheaves five or six on each side, and cover over all with two head-sheaves, which are stuck, butt to butt, by the two men who are setting up the sheaves, who then open up the under side of each, and placing them over the ridge, make each embrace the end sheaves.

In the Midland Counties, in some districts where hand-reaping prevails, four sheaves are stuck down upon the long stubble, and two others, butt to butt, are bound around the heads of the four with a straw band, making the whole almost impervious to weather, and safe against a storm of wind.

Oats, where a bulky crop, are almost everywhere treated in the harvesting, and tied in sheaves and stooked, like wheat. Except where a very bulky crop, it is, however, in the Southern Counties common both with oats and barley, and almost universally the practice in the case of the barley crop, to mow the crop and let it lie till nearly dry in swathe; then to turn it with the rake, and break it into little cocks with the large sheafing prong, before it is carried.

The carrying of our grain crops, and the ricking them, is done differently in different districts. In the South the use of the two and three horse waggon is almost universal. The wheat is built in large round forty and fifty quarter stacks, and thatched, and the barley is put in barns. The oats are built either in stacks or barns. In a hurried harvest time, it is also becoming general to build the corn in the fields where it grew, and thresh it out there too by the use of the moveable threshing machine and engine. In the North it is almost universal to build the grain crops in a stack-yard close by the farmery, where they can be carried in to be threshed by a fixed machine close by the granary; and it is usual to make small cylindrical stacks, holding from twenty to thirty sacks of grain apiece. In the paragraph, for instance, already quoted, the produce of 140 acres of corn is spoken of as built in fifty-five of these little round stacks.

It is a useful practice to let a share of the corn-carrying by contract. And in the case of one-horse carts being used, one or two sets or companies of three hands—viz., a man to pitch in the field, and a lad to load on the cart, then a man to pitch from the cart to the rick—will take the labour of “leading” all the corn upon the farm, at the rate of from 10*d.* to 1*s.* 2*d.* per acre, according to the bulk of the crop.

They are of course kept going by carts being supplied to them, and by the corn being built out of their way as fast as they can pitch it. And for this purpose a man and boy, hired servants of the farm, are kept on the rick, and a boy is employed to bring the emptied cart back to the field, and to take the full one as soon as it is loaded and roped. Three carts suffice to keep a company going, provided the field be not more than 1000 yards from the rick.

The comparison of one-horse carts with waggons for the general use of the farm, and especially in harvest time, has long given rise to different opinions. This difference still exists, neither party yielding much to the other, although it has been proved over and

over again, that the use of the long, wide, low-framed body on a pair of wheels, is more economical than that of the waggon in the harvest field, as that of the light one-horse cart is for taking dung to the fallow field.

Mr. Pusey spoke plainly on the subject in the eleventh volume of the *English Agricultural Society's Journal*. He said—"There is a change which gives a great saving of horses, which has been proved to do so over and over again in this Journal, which might be used almost everywhere; but about which farmers have been, to say the least, rather slow. I mean, of course, the exchange of waggons for carts. In Northumberland light carts with a single horse are used for all farming purposes. In Bedfordshire they have light carts too. In the South we have well-made waggons; but with three horses. The Lincolnshire waggon is like a railway-truck on the broad gauge. I will not again describe the trial in which five of my horses with carts beat ten horses with waggons at barley cart, the number of men being the same; but here is another trial which has just taken place, with the same numbers and the same issue, on the challenge of Sir John Thorold, at Grantham, this year.

"The trial was made to-day [Aug. 27], in a field of mown oats on Mr. Fisher's farm. The extent of the ground cleared is twelve acres; the crop was a heavy one, and the distance from the stack-yard is a mile and a quarter. On the way, the river Witham is crossed by a ford, and the approaches on either side are steep and almost frightful. As in the former case, the men and boys were equal on both sides, and the number of waggons and of carts on either side was *five*. The *horses* used in the carts were *FIVE*, while those used in the waggons were *TEN*. The time occupied in clearing the ground was four hours and three-quarters. *Both parties began and finished together*, and it was found, by measurement of the stacks, *that the carts had conveyed about two loads more than the waggons*.

"The trial of last week proved favourable to carts on *level* and *up-hill ground*, while this day's result is equally favourable for both *up-hill and down*. In going down to the river, it was found necessary to lock a wheel of the waggons, and to arrange the horses so as to allow of an additional leader in going up; while the carts went straight on, without stop or change of circumstances.

"The saving of horses by the use of Northumberland carts, it is now quite clear, is one-half. What is the saving of outlay at the wheelwright's on entering a farm? I have obtained the prices of the old conveyances from a village wheelwright; they are as follows for a farm of 200 acres:—

<i>Old system.</i>		£	s.	d.
3 waggons, at 35 <i>l</i> .	.	105	0	0
4 3-horse dung-carts, at 14 <i>l</i> .	.	56	0	0
		£161	0	0

New system.

	£	s.	d.
5 1-horse carts, at 11 <i>l.</i> 10 <i>s.</i>	57	10	0

So that the new plan costs but one-third of the old-fashioned outlay. The carts are Busby's prize carts, suited for all purposes: easy for the horse, as the wheels are rightly made; easy for the labourer, as they are much lower than other carts; and wonderfully cheap, as they cost but 11*l.* 10*s.*, while for my own I paid 18*l.* 18*s.* a few years ago. Here, indeed, since farmers have compared the two systems, no one buys waggons in stocking a farm; but those who have waggons do not like to buy a new set of carts. I should say they had better sell their waggons while they can, and if they cannot, make a bonfire of them. To use them still, is like running a stage-coach in these days between London and Bath."

Beans.—The mode of harvesting is precisely the same as already described for the winter beans. The period of cutting is not, however, generally until next month.

The following is Mr. Shirreff's experience in East Lothian, of the liability of the different grain crops to suffer injury from rain when tied in sheaves and stooked, as is the practice in the North:—

"Let it be supposed that the soil is in good condition, and that the wetness extends throughout the entire period of growth, then the oat will certainly sustain the least injury, and wheat the most. Should an excess of wetness be confined to the period of harvesting, then barley will be least injured, and oats the most. These conclusions are unquestionably just when the crops are bound into sheaves and properly stooked, although the case may be otherwise when the crops are harvested like hay.

"The oat being found congenial to high latitudes, and ripening at a low temperature, accounts for the plant being found able to cope with wet seasons.

"And from the ears of barley adhering closely and securely, and being entirely free from chaff, rain seldom penetrates far into the sheaves, and wet ears are easily dried, and hence this grain is seldom injured by sprouting in the field. In 1857 the wheat and oat crops of East Lothian were most extensively injured by sprout, while barley was little affected. The power of barley to cope with wet harvests is universally admitted by the farmers of this country. With wheat and oats the case is very different. Sheaves of these grains readily admit rain, and from their seeds being enveloped with chaff which long retains moisture, they are easily sprouted, and more especially oats.

"In 1857, in a field of unripe wheat standing upright in an exposed situation, I found 5 per cent. of the grains sprouted. As a general rule, the riper and drier the grains are the sooner do they sprout in a wet harvest, and hence the advantage of a reaping ma-

chine in expediting the cutting down of crops before they have attained full maturity."

Let it be added as a caution to the young farmer, not to let his anxiety get the better of his patience in the harvest field, but to wait resolutely until the corn is dry before it is carried. In the western counties it is common to "puck" the corn in the field in difficult weather, *i.e.*, carry it by hand as soon as nearly dry to different points all over the field, about a cart-load to each, and build it there in little mows barely two sheaves' length in diameter, and perhaps ten feet high, securing the top with a little cut stubble; letting the weather dry it in those "pucks," and thereafter carrying it to barn or rick. It is also customary, as already said, to build in very small ricks in the North, in order thereby to be able to carry corn before it is perfectly dry.

What expedients are possible in a wet and tedious harvest time, may appear from the following note by Mr. Hallett, of the Manor House, Brighton, written during the wet harvest time of 1860:—"On the three days, August 30, 31, and September 1, expecting the wet weather to continue, I had thirty acres of wheat reaped and placed under cover in barns, hovels, cattle and implement sheds, &c.,—in fact, in everything that had a roof to it,—setting each sheaf upright on the ground, thus exposing the whole of it to the action of the air. Each acre of sheaves occupied an area of 400 superficial feet. The wheat was cut when dry and carried immediately; it is now in excellent order, and my people commence threshing it to-morrow. Had the wet weather continued, the whole might have been removed in a few days, and stacked either out of doors or under the same roofs, making room in the former case for thirty acres, and in the latter case for at least twenty acres more. To show that in the extreme case of the weather not permitting the wheat to be cut dry, it might still be saved, I may mention that two waggon loads of sheaves standing in the field throughout the wet week ending the 25th of August were carried on that day in the pouring rain and placed under cover. They were then soaked throughout, and are now, September 10th, fit to thresh. I had one field of ten acres dried in the straw on three kilns in a malt-house, each of which was twenty-five feet square, and contained upwards of an acre of sheaves."

Perhaps it may be well to add as to the payment of wages for harvest work, that it is becoming more and more to be recognised as good management to pay day's wages only in the form of money. The practice of giving large quantities of beer as part payment for labour is mischievous—of little real use to the labourer himself, and injurious in the long run to the habits of the labouring class in the districts where the custom prevails. A well-known Gloucestershire farmer declares it as his experience, that not only are these drinks useless, but pernicious to a hard-worked harvest-man; he has no

hesitation in declaring that the labours of the harvest-field and the stack-yard cannot be conducted to the best advantage unless all intoxicating beverages be abandoned. His advice is that the men should be paid in money only, and left to provide themselves with such beverages as they choose; his own men use cocoa principally. Where, however, men are working a distance from their homes it is an advantage to have the means of making tea or something similar provided by the farmer on the spot, or at the least to have a facility afforded for obtaining hot water. There is ample testimony to the fact, that well-fed men do their work as efficiently without beer as with it, saving more money for the use of their families, proving more valuable servants to their masters, and more respectable and worthy members of the community. It is to be hoped that whenever an alteration of this kind is made by the master, some special effort will be made to remove any prejudices that may exist in the men's minds with regard to it. The great point is to let them clearly see that it is intended for their advantage even more than for that of their masters.

Turnip and Rape-Seed.—Crops of turnip-seed, and rape or cole-seed, are extremely various, uncertain, and subject to many misfortunes: they must be conducted with great spirit, or the loss will probably not be small. The principal point is to make good use of fine weather; for, as they must be threshed as fast as reaped, or at least without being housed or stacked, like other crops, they require a greater number of hands, in proportion to the land, than any other part of husbandry. The reaping is very delicate work: for if the men are not careful, they will shed much of the seed. Moving it to the threshing floor is another work that requires attention; the best way is to make little waggons on four wheels, with poles, and cloths strained over them: the diameter of the wheels about two feet; the cloth body five feet wide, six long, and two deep; and drawn by one horse: the whole expense not more than 30s. or 40s. I have, on large farms, seen several of these at work in a field. The turnip or rape is lifted from the ground gently, and dropped at once into these machines, without any loss; they carry it to the threshers, who keep hard at work, being supplied from the waggons, as fast as they come, by one set of men, and their straw moved off the floor by another set; and many hands of all sorts being employed, a great breadth of land is finished in a day. All is stopped by rain, and the crop perhaps damaged; it is therefore of very great consequence to throw in as many people as possible—men, women, and boys, to make the greatest use of fine weather.

Gleaning.—The custom of gleaning is universal, and very ancient: in this country, however, the poor have no right to glean but by the permission of the farmer; but the custom is so old and common, that it is scarcely ever broken through. It much behoves

the farmer, in some places, where it is carried on to excess, to make rules for the gleaners, and not suffer them to be broken, under any pretence whatever.

The abuse of gleaning in many places is so great, as deservedly to be ranked among the farmer's evils: the poor glean among the sheaves, and too often from them, in so notorious a manner, that complaints of it are innumerable. Make it therefore a law, that no gleaner shall enter a wheat field until it is cleared of the crop: this is the practice in many places, and great advantages are found from it. But, upon this plan, always desist from turning any cattle into the field until the poor have gleaned it; for if a use is made of keeping them out while sheaves are there, merely for an opportunity of turning hogs and other cattle in, it is double-dealing and unpardonable meanness.

A concluding word may be allowed in praise of the good old English custom of harvest-home. As was well said by the Rural Dean on a late occasion of this kind, in the parish of Symondsburry, near Bridport:—It has been a reproach to Old England that in these merry-makings we are too apt to disgrace ourselves by intemperance, rioting, and an unseemly way of rejoicing; he thought the reason of it has been that the gentry, the clergy, the farmer, and those whom the more humble are apt to look up to as leaders, have deserted these meetings, and the consequence is that they are left to those who are disposed to riotous and disorderly conduct. He was quite sure the way to prevent that state of things would be for the gentry, the clergy, and all others who have an interest in their fellow-creatures to join in such gatherings. It would tend to do away with that distrust which is likely to arise between class and class, and to show that we are all bound together in one common interest—that we all have need one of another, that the farmer cannot do without the labourer nor the labourer without the farmer, that the rich cannot do without the poor nor the poor without the rich, and that the more we recognise the ties which bind society together, the happier shall we be as a nation.

When a day's enjoyment of this kind begins with a service of thanksgiving to Almighty God for his bountiful goodness, it is not likely to degenerate in the way thus hinted at.

IV.—CROP CULTIVATION.

Horse and hand-hoeing, when necessary or possible, of turnips and mangold wurzels and carrots, is carried on during August. Turnips may even yet be sown on land properly tilled after vetches, trifolium, and other early spring crops. Also after rye and pease, and winter beans and flax, and even after an early crop of wheat.

There are many advantages connected with an early harvest.

The farmer of South and Midland England is better off than his brethren in the North. Their harvest time, so late as September, and often as October, makes it utterly impossible for them to attempt anything like an efficient fallow of their stubbles; and there are some crops of great value, both for the current and the ensuing year, which they are thus unable to cultivate at all.

In the southern counties a considerable extent of stubble turnips and of the white mustard is put in after wheat and oats. The land is ploughed and harrowed, and some superphosphate of lime, two or three cwt. per acre, is sown broadcast; and the turnip or the mustard seed—three or four lbs. per acre of the former, two or three times as much of the latter—is sown broadcast, and covered in by the harrow and the roller to sprout after the first shower, and to yield a useful fold for sheep before winter; or, in the case of the turnips, a useful bite for ewes and lambs in spring.

Rape also may be sown on land prepared as above.

Cabbages.—The beginning of this month, the second horse-hoeing should be given to the Midsummer planted crop of cabbages: the earth thrown into a ridge or afterwards torn down by the horse-hoe, in the middle of each interval, by the first cultivation, should now be split by the double mould-board plough, and thrown half to one row, and half to the other: this earth, which has been some time exposed to the weather, will be in fine order for the young fibres of roots to spread in; nor need it be stirred by the succeeding operations; for the cabbage is a plant of such a luxuriant growth, that the roots have power to follow the well-pulverized land thus thrown up; and the cabbages will certainly be of a size proportioned to the quantity of food the roots command. Care should also be taken to keep the tops of the ridges perfectly clean from weeds by the hand-hoe: none should be suffered to grow; for on this part of the management much depends.

This is the season of sowing for those crops that are transplanted in April. Plough a piece of well-fallowed land until it is as fine as a garden; then manure it amply with dung, and turning it in, harrow in the seed; a pound of seed for every three acres of the intended crop.

But a preparation superior to ploughing and dunging, is that of paring and burning a thin coat for plenty of ashes, and adding a thin dressing of dung; turn them in together, and roll in the seed, and bush-harrow. The plants thus escape the fly and slug.

It is well to have as many August-sown cabbages as will be wanted for cattle, sheep, and swine, from the first of the following October till the last of December. The size they come to is superior to spring-sown plants, but they will not, in general, last longer than December. The use is however so exceedingly valuable for autumnal feeding of oxen, feeding cows, fattening wethers and swine, that one

may, without hazard, assert, the farmer who does not make a provision of them, to be negligent in a very material point of his business.

The potato crops must be hand-weeded, if necessary ; but it is now too late to horse-hoe.

Trifolium Incarnatum, sown now, furnishes a supply of most useful fodder, especially for the stable early in May. The cultivation of the crop is also particularly easy. If the stubble be clean, all that is needed is to sow twenty lbs. of the seed per acre as soon as practicable after harvest—in August, if possible. The seed is sown broadcast over the stubble, and simply harrowed in. If the land be ploughed and cultivated and manured, the plant is not likely to come so well as when it is simply scattered over the hardened surface of the field, and brushed or harrowed in after the first shower that falls. The crop then comes thickly, and if it escapes the slug, it will yield on land in ordinary condition a heavy cutting of most useful fodder for the stall and stable early in the following month of May. The only fault of the crop is that it remains at its best for so very short a time. Between the period when it is coming into bloom, and that in which the seed is forming, and the leaf has fallen, and the stems have become hard and unpalatable, there is barely a fortnight or three weeks when it is at its best. A comparatively small extent is thus all that is needed on the largest farms. It makes coarse hay, and thus is useful only as a forage crop. The shortness of the time during which it is available for this purpose is thus a serious drawback on its value, and one which cannot be successfully met by any attempt by various seed-times through the autumn to obtain a succession of crops.

Messrs. Vilmorin, of Paris, have, however, introduced three varieties of the trifolium, differing in the period of flowering, although sown together. Their *trèfle incarnat ordinaire* corresponds to our ordinary trifolium incarnatum, of which an acre will generally provide during May all the produce wanted as forage on farms of ordinary size while it remains good. Their *trèfle incarnat tardif*, sown the same day as the other, attains its fit state a fortnight later, so that another acre sown with it comes into use immediately on the exhaustion of the other ; and their white-flowered *trèfle incarnat tardif* is a still later sort. The value of the crop for forage purposes is thus in effect tripled. If sown in all these three kinds, which any of our large seedsmen now supply, three times the ordinary extent upon the whole, *i.e.*, in fact, the ordinary extent of each, may be cultivated with the certainty that it will all come into use successively, and thus continue good during thrice the usual length of time.

It is well to add that blanks already apparent in the young clover

among the barley stubble may be filled up by scattering some trifolium seed over them, and harrowing the ground.

Permanent Grass.—The present is as good a time as any for laying land down permanently to grass, the method of doing which was described in the month of April.

The two following plates represent (fig. 54) heads of the natural size of the different clovers cultivated, whose character and uses are given at page 152, and (fig. 55) shows the habit of growth of the three more commonly cultivated species.

In fig. 54, No. 1 represents the habit of growth of the common yellow clover—*medicago lupulina*; 2, the habit of growth of *trifolium medium*—the zig-zag clover (sometimes called cow grass); 3, the habit of growth of *trifolium pratense*—common red clover. They are all drawn on a small scale, so as merely to exhibit the style and manner of their growth.

In fig. 55, we have heads and leaf of the natural size of—1, *trifolium hybridum*—alsike clover; 2, *trifolium incarnatum*, above described; 3, *trifolium repens*—white clover; 4, *trifolium pratense perenne*—cow grass; 5, *trifolium procumbens*—hop trefoil; 6, *medicago lupulina*—black Medick, or yellow clover; 7, *trifolium pratense*—common red clover.

The Index may be consulted for reference to the plants here represented. Further information will be given of them, and of the grasses also to be represented, next month, before which time it is rarely possible to do much in the way of autumn cultivation of stubbles.

The second cut of clover, when mown either as forage or for hay, is generally ready for the scythe in August. If intended to be left for seed it is rarely ready till the end of September.

We add, as a general memorandum of what is doing in August on a south country farm, the following report from a Hampshire farm this month:—

The horse labour upon the farm since we completed turnip sowing upon the fallow land, has been chiefly preparing the fallows for wheat, &c., carting and stacking second cut of clover-hay, carting pease, and also wheat. We have completed wheat harvest, and also got up a portion of the barley crop, and have been employed three days ploughing wheat stubbles and drilling in turnips: we use as manure the same application as for the early turnips, viz., superphosphate of lime four bushels, and forty bushels of mixed night-soil and ashes; but we drill much closer than for early turnips, namely, fourteen inches between the rows. At this late period of the season, in fact, we generally prefer sowing the manure and turnips both broadcast when we do not expect the turnips will grow large. Instead of hoeing them, we only drag and harrow them for

Fig. 54.



Fig. 55.



the purpose of thinning the plants, and accelerating their growth; in this way we have often obtained a good produce; for when we cannot expect large roots we must depend upon greater numbers to give the crop. We are quite satisfied of the advantages of drill culture for all early turnips, where we can obtain roots of a large size, and can give space enough between the rows to have the full benefit of interculture by the use of the horse-hoe; but we are not so satisfied of the advantages of drilling turnips as compared with broadcast at this late season of the year, as we can neither expect to grow large roots, or to use the horse-hoe with advantage. Our labourers have been engaged chiefly in harvest work; they have been fagging wheat—reaping is going out of fashion—mowing barley, oats, and clover, stacking wheat, barley, and hay; second-hoeing swede turnips, hoeing white turnips, thatching corn-ricks, &c. They will probably be employed during the next fortnight in completing the Lent grain harvest, having barley, oats, and beans yet to be cut and housed; we shall also sow more stubble turnips at intervals during the month. *Trifolium incarnatum* must also be sown, the sooner the better. We set much value on this crop; indeed, since its cultivation has been better understood and rendered more certain, it has risen in general estimation as a green crop for early feeding, &c.

Hop Farm.—Continue to hoe or pick all hop-grounds as often as any young weeds appear; and where there is no chance of a crop, sow turnips, which will be pulled up in winter to feed sheep in the yards. Keep horses constantly at work hoeing whenever there is tolerably good prospect of growing hops, by this means you deeply pulverize the soil, and need not fear dry weather.

Good cultivation requires all the advantages which may be obtained from atmospheric influence, combined with the retention of moisture by capillary attraction. These benefits can only be attained by a frequent stirring of the soil.

V.—THE LIVE STOCK OF THE FARM.

Horses receive the same management as last month; they are not yet in full labour again, and do not require more than as much cut clover or vetches as they will eat, along with perhaps a bushel of oats weekly a-piece.

Fattening Cattle are still in their pastures, or fed in stalls or boxes on cut green food, with oil-cake, cotton-seed cake, or steamed rape-cake, as already described.

The Work of the Dairy continues as heretofore. The following memoranda are from the pen already quoted:—

Truckle Cheese.—This is a good time for making loaf or truckle

cheeses, which are made from six to nine inches deep, and about nine inches across. It being rather difficult to fill vats of this description, it has been found more convenient to have vats made of small staves in the same manner as a pail or bucket with white hoops round them, and without bottom. A piece of board, rather larger than the vat, is provided to place at the bottom when the cheeses are being made; and it is kept underneath until they are turned out. These cheeses, if not made with great care, are very apt to bulge in the sides, and thereby lose their beauty, and not only is their appearance affected, but the quality also is inferior when the cheeses do not retain the proper shape of straightness on the sides and flatness on the top. The shape consequently marks the quality. Sometimes broad bandages are kept round these cheeses for a time, when first placed on the shelves, to prevent their getting out of shape. When the vat is about half full, a small table-spoonful of fine salt should be put into the middle of the cheese, and well rubbed into the curd, taking care that it does not spread to the outside, which would cause it to separate, and be of injury to the cheese. In making truckle cheeses the curd should be quite sweet, thoroughly crumbled, and made as dry as possible before filling the vats, and it should be pressed very firmly in with the hands, and allowed to remain in the press four or five days—turning them every day, and salting them three times. Truckle cheeses, after being kept twelve months, are fit for use. They always bring a higher price than other cheeses, and are recommended as the most convenient size for the table; and when the top is carefully cut off in one piece it can be used as a cover to the cheese, which will keep it from becoming dry during the time of consumption. Exposure to the air invariably deprives all cheese of its original freshness of flavour. This form of cheese is in some dairies made throughout the whole season, and in others none but these truckle cheeses are ever made. There is, however, a risk, under ordinary management, of their bulging and heaving during the extreme heat of the summer, owing to fermentation, and this difficulty does therefore in most dairies confine the making of this sort of cheese to the autumn months, when less heat interferes with the ripening it.

Devonshire Cream.—The method is to set up tins of milk for twelve hours; then place them either upon a stove or upon an iron stand in a furnace of boiling water. In Devonshire the milk is put in a tin vessel as soon as it comes from the cow, and placed at once on the stove, where it stands twelve hours, and then the stove is heated; this prevents the awkwardness of carrying the full vessel when there is a danger of breaking the cream, which ought not to be done before it is put on the stove. The milk should be heated gradually until quite scalding, and a skin appears to form over the surface of the cream and it seems to rise in small blisters, but it

should not be allowed to boil. It should then be carefully taken from the stove, or what is better, the fire be removed from the stove, and it should be allowed to stand twelve hours longer before it is skimmed; it is better that the skin should not be broken until twelve hours after it has been heated, when the cream will be found of great thickness, and be readily made into butter by beating it by the hand in a bowl. Half an hour is generally sufficient for this operation; this plan of course only allows of the milk being once skimmed. Butter made thus is generally very sweet and good, and it is imagined there is no loss of cream, the extra thickness quite making up for the loss of the second skimming of the milk.

Any of the herd of dairy cows not expected to calve next season should now be dried and turned off as grazers, as the flesh they will gain before winter is of more value than their milk for the remainder of the season; and by giving them a good run of grass, they will have made considerable advance towards fatness, so that when the keep in the grass-field becomes short, they will be in such condition as to be sold at once to advantage, or by giving them some early turnips, hay, and cake, they will soon become very good beef.

The Flock.—In August the earlier lamb fairs of the season take place, and the surplus stock of lambs, where breeding flocks are kept, is parted with. Attention is still necessary to guard against the attacks of the fly; and this is the usual season to dip the lambs as a preparation against tick, lice, and scab. The subject was referred to in June.

In the South of England the ram is turned with the ewes in August for the main crop of lambs. The horned ewes are now forward in lamb, and commence lambing, in fact, so early as October.

Among the Lammermoors, on the other hand, the following is the report for August:—

The Cheviot lambs are all weaned on the 10th, and after having been sorted, a sufficient number of ewe lambs are retained to keep up the stock, while the smaller lambs are sold for the purpose of breeding "half-breeds," or crosses between the Cheviot ewe and the Leicester tup. The top wedder lambs are driven to market. The ewes are milked once or twice, to prevent the milk injuring their udders. Of the black-faced lambs, such as are intended for keeping are removed from the ewes about the middle of August, whilst those which are destined for the butcher must remain a little longer to suit purchasers and the different markets to which they may be sent. Towards the latter end of September the drafting and sale of the oldest ewes will take place. The Cheviots are disposed of at four, and the black-faces at four and five years old.

Swine.—There is no particular memorandum needed regarding

their management in August, excepting that they are to be turned into the stubbles of all kinds of grain as soon as possible, water being supplied to them in troughs.

SEPTEMBER.

The ordinary weather of this month is represented in the table on the following page.

The subjects engaging the attention of the farmer in September include—(1) *the completion of harvest work* ; (2) *the relation of master and servant* ; (3) *autumn cultivation* ; (4) *steam culture* ; (5) *crop cultivation* ; (6) *management of the live stock* ; (7) *farm accounts* ; (8) *the farm lease*.

I.—HARVEST WORK.

Grain crops.—Even in the southern counties harvest work is not often completed in the month of August, and sometimes, as in 1860, September is there, as it always is in the more backward parts of the island, the main harvest month. The labour is of course prosecuted with industry and patience until its completion. Immediately on the settling of the ricks, they should be thatched—the straw being either spiked or roped on, according to the practice of the district. The outsides should then be clipped or shorn, all the clippings being carried with the rakings of the fields into the barn to be immediately threshed.

The thatching and shearing of the small twelve and fifteen quarter ricks common in Scotland may very well be done for 3s. a rick—straw ropes, prepared beforehand, and wetted straw, being provided to the party contracting for the work ; and probably the labour of thatching may be put down at 1s. 4d. per acre. Messrs. Maggs and Hindley, of Bourton, Dorsetshire, have invented a very ingenious thatch-weaving machine, by which a large quantity of roofing fabric, adapted for the straight roof sides of long, ridge-like ricks may be easily and rapidly provided.

Potatoes.—The end of this month and the beginning of October are the common harvest time of this crop. Where the rule of planting early sorts prevails, in order to their being ripe before the time when the disease generally attacks them, they will be ready for digging earlier than this. Early potatoes should be sold as soon as ready—the later sorts may be either sold or pitted. The digging, when done by hand, will cost 20s. to 25s. an acre for lifting the crop,

THE WEATHER OF SEPTEMBER.

LOCALITY.	AUTHORITY.	Mean temperature.		Lowest mean temperature.		Highest mean temperature.		Greatest heat.	Lowest maximum heat.	Highest minimum cold.	Greatest amount of rain.		Smallest amount of rain.		Average number of rainy days.		No. of years' observations.
		Mean temperature.	Lowest mean temperature.	Highest mean temperature.	Greatest heat.	Lowest maximum heat.	Highest minimum cold.				Average amount of rain.	Smallest amount of rain.	Average number of rainy days.	Smallest number of rainy days.			
Guernsey.....	Dr. Hoskins, F.R.S.	53.1	54.3	60.5	75.0	64.0	53.5	47.0	inches.	3.4	0.6	6.8	12	4	19	12	12
Helston	Mr. M. P. Moyle	60.5	57.3	64.0	85.0	67.0	48.0	37.0	inches.	2.7	0.2	5.3	11	4	18	16	16
Exeter	Mr. W. H. Ellis	58.3	53.8	61.0	82.6	68.7	45.5	38.8	inches.	1.8	0.7	3.1	17	8	27	7	7
Ventnor, I. of Wight	Dr. Martin	54.6	51.9	57.4	70.0	61.0	43.0	33.0	inches.	4.7	2.3	6.7	18	11	23	9	9
Worthing, Sussex	Dr. Barker	57.7	54.8	61.5	75.6	67.8	50.5	41.2	inches.	2.7	1.1	4.5	13	6	22	9	9
Clifton, near Bristol	Mr. W. Burder, FRAS	60.2	56.9	63.2	91.4	69.7	47.9	39.4	inches.	3.6	1.3	5.7	15	7	23	8	8
London Royal Observatory	{ The Astronomer } Royal, F.R.S.	56.3	51.3	62.3	86.4	66.7	53.5	32.0	inches.	2.2	0.7	3.9	13	6	17	90	90
Bedford	Dr. Barker, F.R.A.S.	57.1	53.4	60.7	84.0	69.0	45.0	34.0	inches.	1.7	0.5	3.2	—	—	—	10	10
Lampeter, near Cardigan	Rev. Prof. Matthews, M.A. ...	55.4	51.4	58.8	86.6	68.6	39.8	25.8	inches.	3.9	1.0	5.9	15	11	21	6	6
Norwich	Mr. W. Brooke, FRAS	55.5	50.8	59.7	80.0	66.0	45.0	33.0	inches.	2.4	0.7	5.2	12	6	19	21	21
Highfield-House Observatory..	Mr. E. J. Lowe, F.R.A.S.	56.6	51.4	63.2	85.0	70.2	46.5	32.0	inches.	2.6	0.7	5.6	12	6	20	51*	51*
Oxford Observatory	Rev. R. Main, F.R.S.	55.0	51.7	58.1	80.4	67.0	43.0	29.6	inches.	2.9	0.4	7.0	11	5	16	34	34
Grantham	Mr. J. Jeans, F.R.A.S.	55.4	51.9	58.6	78.4	66.0	43.2	34.0	inches.	2.1	0.3	4.7	12	5	19	10	10
Hawarden, Chester	Dr. Moffat, F.R.A.S.	54.8	50.9	58.7	78.0	63.0	46.0	36.0	inches.	2.3	0.7	5.3	12	2	19	11	11
Manchester.....	Mr. G. Vernon FRAS	55.3	51.7	59.2	85.5	66.8	41.5	30.3	inches.	2.8	1.0	4.6	14	8	24	12	12
Leeds	Mr. H. Denny	56.1	52.0	60.0	85.0	70.0	42.0	32.0	inches.	2.1	0.4	3.5	15	7	21	10	10
York	Mr. Ford	54.2	51.2	58.3	79.0	65.0	41.0	30.0	inches.	2.1	0.3	4.3	12	5	18	20	20
Scarborough	Mr. B. Cooke	54.4	50.8	57.3	70.4	61.0	48.0	40.0	inches.	2.3	0.3	3.7	8	5	11	6	6
Isle of Man.....	Mr. J. Burman, FRAS	55.0	53.3	56.5	73.5	68.1	42.8	38.0	inches.	2.2	0.5	4.1	11	5	14	7	7
Durham Observatory	Mr. A. Marth, FRAS	52.0	50.5	57.1	74.1	62.2	41.1	29.8	inches.	2.6	0.3	5.2	12	2	18	14	14
North Shields.....	Mr. R. Spencer	54.2	50.4	58.7	74.6	64.2	46.8	32.2	inches.	3.5	0.1	8.6	15	3	25	16	16
Silloth	Rv. F. Bedford, FRAS	54.3	51.9	56.6	76.1	67.0	37.6	31.8	inches.	3.7	1.1	5.6	17	13	20	3	3

* Observations at Highfield House on temperature extend over fifty years, and at the Royal Observatory over ninety years.

and picking them up, and placing them in carts. When the crop has been planted in drills opened by the plough, they may be lifted by the double mould-board plough, every other row being done in the first place, and the potatoes gathered before the alternate rows are treated in like manner.

Hanson's potato digger, made by Coleman, of Chelmsford, is a useful machine now frequently met with on the farms of potato growers. It moves the whole of the earth of each row in which the potatoes are embedded, and scatters it on one side, the potatoes which it contained falling on the surface, and being picked up by women and children. A pair of horses drawing it will, in one hour of the morning, scatter as many potatoes as ten women and children will gather during the day.

Where "seed" for next year is to be preserved, they should be dug and exposed to the sun for a week, covering them during night in case of frost. When dried and greened, put them in a narrow pit, and cover them well over.

Potatoes should be gathered into three lots—the larger ones for sale, the moderate-sized for "seed," and the "trash," including all the tainted ones, for pigs. They are carted to a bed, about four inches deep and three feet wide, in any convenient part of the field, and piled up ridgewise, and covered with a light coat of straw, and when dried covered with a foot-thick of earth, the ridge line being thatched.

Four to six tons are now an average crop, though eight to twelve tons used to be common.

Hop-picking proceeds in September. To name it is sufficient in such a book as this, for no prudent man would venture upon so operose a business as this article of culture, by means alone of such information as he could find in books.

Buckwheat is harvested in September. It is cut when most of the seed is ripe, and left in bundles till dry, and moved once or twice as gently as possible, not to shed the seed, and then carried to the threshing-floor. The seed is good chicken corn; its straw makes useful litter.

II.—RELATIONS OF MASTER AND SERVANT.

At Michaelmas there is a great breaking-up and re-uniting of these relations all over the country. It is well that they should be based not only on adequate payment by the master for the services he receives, but also on mutual good-will and esteem. It is the lack of this as much as of the other that produces such frequent changes of servants on the farm. I propose here to extract from a paper read by me before the Society of Arts, in Dec., 1859, and since published along with a further discussion of the subject, in the "Handbook of

Farm Labour,"* remarks descriptive of the modes of payment prevalent in the country, and of the relationship between master and servant which is actually in operation.

Mode of Hiring and Paying Labourers.—There are three ways of paying for agricultural labour. (1) partly in money, but with an immense variety of perquisites; (2) partly in board and lodging in the house; (3) in money solely. These three include, I believe, all the various systems of payment adopted.

1. Of the first I give two instances from the extremes of the island, Forfarshire and Dorsetshire. A paragraph on this subject occurs also at pages 263-4.

Mr. Bell, of Ferryden Farm, Forfarshire, writes to me as follows:—

"Our ploughmen receive per annum 17*l.* in money, 6½ bolls oatmeal (140 lbs. a boll, present price 17*s.* 6*d.*); 1½ Scotch pint warm milk (3*d.* a pint), during summer six months, 1 pint in winter ditto; 15 cwt. potatoes, and house and garden at say 3*l.* This for a married ploughman. Unmarried: 20*l.* and 22*l.*, 1 pint warm milk daily all the year, 6½ bolls meal, and fire and lodging in a bothy. At hay and corn harvest they get two bottles beer daily, and bread and beer while leading to the stack-yard. Married men get all their fuel driven by their masters."

I value those wages at 34*l.* 6*s.*, or 13*s.* weekly. The daily workers, when getting something like steady work, have 12*s.* a week in winter, and 15*s.* in summer, with no beer or other allowance.

In Dorsetshire, Mr. Saunders, of Watercomb Farm, Dorchester, says:—

"My agricultural labourers of different callings all live on the farm near their work, where it is convenient for most of them to go in to dinner every day. I have eighteen cottages, for which I never receive any rent, as my men all live rent free, and most of them have good gardens besides other potato land free. It is a very great accommodation to labourers to reside near their work; it is quite worth 1*s.* per week to a man not to have to travel a mile to his work morning and evening: and all have their regular pay, wet or dry weather; there is no loss of time except they are working by piece work, which most of them get in their turn during the year, when they generally earn from 10*s.* to 15*s.* per week, according to circumstances. And all this is in addition to their yearly privileges, which, as many of my labourers have said to me at different times, 'is nearly half our living,' referring to a cottage garden, potato land, and the privilege of having grist over that of buying bread of a baker, as I regulate the grist by allowing a peck a head to the family of workers in a house. I think our system is nearly equal to other

counties, where they give nearly double the wages, but no house, nor other privileges, nor pay for wet days. In this county we agree for a family at a certain sum, from the 6th of April to the 6th of April in the following year; and some of my men have continued on my farm with me for more than thirty years without change. The following is about the general run of wages in our county:—

	£	s.	d.
House, good garden, worth to let, 4 <i>l.</i> a year	4	0	0
Weekly wages, 8 <i>s.</i> , and 30 perch of potato land ploughed in with their potatoes (often growing 15 sacks, now worth 10 <i>s.</i> per sack, which allowing the seed out, would be worth 5 <i>l.</i>)	25	16	0
200 furze faggots, carried home free to the cottage	1	0	0
28 cwt. best coals, carried home at 1 <i>s.</i> per cwt.—advantage worth at least	1	14	0
Extra for harvesting, cash 1 <i>l.</i> , and 1 gallon of ale per day	2	0	0
Every journey with team, 1 <i>s.</i> , average one per week	2	12	0
3 quarts of ale per day at haymaking, for eight weeks, at 9 <i>d.</i> per gallon	1	7	0
Bushel of wheat per week (more, if there be other workers in the family) at 5 <i>s.</i> , not much advantage now, say 6 <i>d.</i> per week, but when dear 3 <i>s.</i>	1	5	0
	£39	14	0

The *ploughman's* (*carter's*) wages are thus about 15*s.* per week.

My shepherd has the same as the horse-man, except that he earns about 3*l.* extra for sheep which he shears, and he has 1*s.* per score for all lambs bred, which at about 600, is 1*l.* 10*s.*; and also 6*d.* for every ram let or sold, generally 2*l.* 10*s.* in all

	7	0	0
Take from this the difference of carter's journey money, which is	2	12	0

Leaving in favour of shepherd	4	8	0
Wages and perquisites as carter's account	39	14	0

<i>Shepherd's</i> wages weekly 17 <i>s.</i>	£44	2	0
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"The common *labourer* receives 7*s.* per week, house, garden, potato land, 200 of furze, 15 cwt. of coals, grist as I have before stated, at 1 peck per week for every one who works, great and small, some at 5*s.* per bushel, and some at 6*s.* per bushel; and most of my labourers have piece-work at different times of the year when convenient. I consider, on an average, a good labourer's place with me is worth fully 12*s.* per week."

This is a most elaborate scheme of payment, and certainly a very liberal one, though I do not value the items so highly as Mr. Saunders does by about 6*l.* a year, making the yearly wage of his ploughman 33*l.* 14*s.*, or as nearly as possible 13*s.* a week. I may add here, in illustration of the Dorsetshire method of paying wages, that at a recent meeting of the Blandford Farmers' Club, it was resolved that the wages of ordinary agricultural labourers then paid in the county amounted, taking perquisites into account, to at least 12*s.* a week,

while for shepherds, carters, &c., 14*s.* or 15*s.* a week was a common payment.

2. Now, over large districts in England another system obtains, of which Mr. Manser, a tenant farmer at Dumpton, near Ramsgate, gives the following very interesting account:—

“Our ploughmen here are generally single, and yearly servants, and are boarded and lodged by the farmer or by his bailiff. They are hired from the 11th of October to the 11th of October each year, and though they sometimes continue for several years with the same master, a fresh agreement takes place every year. They commence as lads at thirteen or fourteen years of age; their duties then are to drive the horses and attend to them in the stables; and we almost invariably find that the younger that these boys go to service (as it is here termed), the better ploughmen and the better labourers they afterwards become. They begin at about 5*l.* wages per annum, which is usually increased every year, as their strength and ability increase, or as master and servant agree; the increase goes on at the rate of about 1*l.* per year, and our head horse-man or waggoner gets from 12*l.* to 14*l.* per year. The cost of their board varies according to the price of provisions, and when they are boarded by a third party it is generally paid partly in money and partly in kind; they always have meat three times a day, and cannot be boarded on an average at less than 8*s.* per week per head.* In some few in-

* The system of hired service, board and lodging being part payment of it, to which Mr. Manser refers, is more particularly described in a paper which was read, some years ago, before the London Farmers' Club, by Mr. Marshall, of Riseholme, Lincolnshire, whose experience was thus described:—

“In some of the southern and midland counties the custom prevails of hiring labourers by the year at a certain sum per week, which is regularly paid every Saturday night, a small deduction, say about 2*s.*, being kept in hand to ensure the service to the end of the contract, the servant in all cases engaging to board and lodge himself at his own expense. This he usually does with the foreman on the farm, who undertakes to supply him with bread, meat, milk, and vegetables, at a fair market price. In addition to the cost of provision, 1*s.* 6*d.* per week is charged for lodging and cooking; no beer whatever is allowed except during hay and corn harvest, when four pints per day are commonly given. The greater portion of the servant's wages is thus absorbed (some being in debt) or spent in some less creditable manner, and the only accumulation he can boast of at the end of the year is that of the 2*s.* per week retained in his master's hands, which he will require for the purchase of clothes, shoes, &c., leaving little or nothing as a fund for the savings bank. In some of the northern counties, and also in North Lincolnshire, with which I am more immediately connected, it is the custom to employ a large number of unmarried servant men and lads, who are regularly hired by the year, from Old May day till Old May day, at the various statutes held in the district for that purpose. At present, wages vary from 5*l.* for lads who can plough and go with horses, to 20*l.* for head waggoners, who are also drill men and stack during harvest. On a farm of 500 acres of turnip land it is customary here to work about fourteen horses, for which five farm servants, under the superintendence and control of a married foreman, are considered sufficient. The foreman with whom those men reside is of course a responsible person, and undertakes to provide them with

stances, however, where there are cottages near, married men are employed as ploughmen at wages of 14s. per week, and a cottage rent free; if they have to pay rent they are usually allowed about 5l. extra for harvest, in addition to the 14s. per week. I find on

everything that is requisite as far as board and lodging is concerned. He also sees that they do their duty during the week, and that they invariably go to church with him on a Sunday once at least. An ample house and garden for vegetables is provided rent free; 30l. a year is in wages given to the foreman, who has also the produce of two cows for five, or one cow for three men; twenty-six stones of bacon (*i.e.*, a fat pig weighing twenty-six stones) for himself, and twenty-six stones for each of his men; he has further forty stones of flour, twenty of best seconds for puddings and pies, and twenty best thirds for bread for each man, one quarter of malt for himself and the harvest men, and one sack for each man servant (equivalent to one pint per day and four in harvest). He has five tons of coal for the year's consumption; he finds candles for the stables and chaff-house, when required; and has 1s. per day for all casual boarders, such as additional harvest men, blacksmiths, carpenters, &c., who work by the day, and have their board. The men have three meals per day. For breakfast hot bread and milk, and cold meat; for dinner, hot meat, pies and puddings, vegetables, and one pint of ale; for supper hot meat, bread and milk, or pea soup. By this means they have always meat three times a day, milk twice, and beer once. They pay for their own washing, and are allowed an interlude of three or four days as a holiday at some fitting period during the year, which always expires on the 13th of May. I believe the quantity of bacon allowed is always consumed, but the flour is a little above what is required. The ordinary consumption of a man, his wife, a servant maid, and five men, usually averages about thirty stones for each person per annum. The annual expenses of their board and wages may be set down as follows:—

	£	s.	d.
Foreman's wages	30	0	0
26 stones of bacon, at 7s.	9	2	0
1 quarter of malt	3	12	0
2 cows, at 3s. 6d. each per week	18	4	0
130 stones of bacon, for five men, at 7s.	45	10	0
200 stones of flour, at 2s	20	0	0
5 sacks of malt, at 9s.	9	0	0
5 tons of coals, at 12s.	3	0	0
Wages:—2 waggoners, at 12l.	24	0	0
" 2 middle men, at 10l.	20	0	0
" 1 boy at 6l.	6	0	0
	£188	8	0

In addition to the above, the foreman's wife shares largely in the profits of this system, inasmuch as she has the butter and superfluous milk from two cows to dispose of, the privilege of raising poultry of every description, and gathering eggs. For these she receives a certain price per couple and per score, out of which she pays her maid servant, and retains the residue as her own perquisite in return for her vigilance and labour. Upon her good management very much depends the comfort and well-being of the whole establishment. These items amount to 188l. 8s. for six men, namely, one foreman and five farm servants, the yearly average for each being 31l. 8s., or within a very trifling sum of 12s. per week. Now, if it be taken into consideration that the ordinary wages of a daily labourer in that district are 15s. per week, exclusive of a very considerable increase during harvest, I think it must in justice be conceded to me that I have at least pointed out to you not only a far cheaper but in every other respect a far better plan."

examining my labour account that my best men on an average of the year earn about 16s. per week, or a little over 40*l.* a year. This includes harvest and haymaking, as well as lost time from weather and other causes, and is the man's earnings independent of the rest of the family." He adds, "Our labourers pay about 2s. 6*d.* per week rent for their cottages, and for this many get but a miserable home. I know of nothing in the neighbourhood so disgraceful as the want of accommodation for labourers. They are (many of them) driven to reside in the worst parts of the towns, many of them in hovels, built or rather stuck up for the sole purpose of investment, without any regard to health, comfort, cleanliness, or morality. No garden is attached, or anything else to make a poor man's home comfortable; he is completely away from the eye of all who feel an interest in his welfare. The consequence I need not describe; there is every inducement for him to spend his spare time and his hard earnings at the public-house or beer-shop; he has often from two to three miles to go in all weathers to his labour; he never knows the luxury of a hot dinner or a meal with his family, except on a Sunday; the children run the streets in the worst parts of the town, and get early imbued in every wickedness. With no father near to correct them, how can it be otherwise? I do hope this subject will be pressed before the public on every favourable opportunity."

There are two local or provincial peculiarities in the relation of farmer and labourer which, though not exactly of the same class as that to which Mr. Manser's letter alludes, may be mentioned in the same paragraph with it; for in both there is part payment of wages in the form of board and lodging. I refer to the so-called "bondager" and "bothy" systems prevalent in the south-eastern and in the north-eastern counties of Scotland.

In the former, the married hind who occupies one of the farm cottages, is bound to provide for his master during the year, a woman worker, who thus becomes the "bondager," receiving 10*d.* to 1*s.* as may be agreed upon for every ordinary day's work she does, and 1*s.* 6*d.* more for every harvest day's work she does. This is a great burden on the man, for it imposes a lodger on him who may be a most undesirable inmate; and such women workers are able to obtain from 7*l.* to 9*l.* as yearly wages, along with their board and lodging, the expense of which is borne by him, and is rarely met by the daily wages which the woman earns for him. And the system is not good so far as she is concerned either, for it places her in the position of a servant's servant, and removes her so far from direct relationship to the master of both, as to impair that interest in her well-being which he might otherwise both feel and exercise.

In the "bothy" system, on the other hand, the young men whom it concerns are directly the servants of the farmer—they are his un-

married ploughmen and labourers; and he provides a room or rooms (the so-called bothy) in which they are lodged apart from the farmer's house, and in which they have their meals, which are, in fact oftentimes prepared by themselves. Of course such an establishment may be so looked after by the master as that it shall be a useful school to all its inmates; but this represents only the possibilities of the case—the probabilities of it, as of every other enforced departure from, or violation of, the family system natural to man, are far otherwise. The evils of the system arise out of the isolation of young men, the impossibility of any but clandestine association with the other sex, and the consequent liability of such intercourse to become licentious. And it is a fact which might have been expected under the circumstances, that there is a greater number of illegitimate births in proportion to the population where the system prevails than occurs elsewhere. The system itself has no doubt arisen out of the absence of sufficient cottage accommodation for the labourers of the district. The responsibility for the evils which have arisen out of it rests primarily, therefore, on the landowners of the locality.

3. The third method of payment is by a weekly sum of money. The amounts given in the several districts of the country vary exceedingly, from as low as 9*s.* up to 14*s.* and 15*s.*: and the only remark to be made upon the system is, that whether the payment be weekly or fortnightly, it will be a great convenience to the recipients if they are paid on Thursday or Friday evening, instead of Saturday. There is, however, under this head, the alternative to be considered of payment by the piece and payment by the day or week. It seems plain that the former is the better plan whenever it can be adopted. A little experience will enable any one to determine the proper price per perch or acre, hundred, ton, or bushel for the operation. The price should be fixed before the work is commenced, and whatever may be the wages earned per week under this agreement, they should never be begrudged. On the other hand, if the wages earned be insufficient, it is better to make it up by letting the next job more liberally rather than by a sum paid as a recompence for the loss, for this would tend to give the labourer hopes of wages to be earned otherwise than by industry. In either case the work should be carefully superintended throughout its performance, as it will demoralize the labourer as well as injure the master if a careless and imperfect performance be allowed. The prices to be paid for various kinds of work are specified at page 265. As regards weekly labourers, care should be taken to pay wages justly—*i.e.*, according to the real worth of the men. Nothing more discourages effort, self-respect, and energy in men, than treating them alike, however different may be their value as labourers.

For all these various customs of payment there must of course

be the general assent of the labourer, and the concurrence of both master and servant ; and so long as a labourer agrees to take certain wages, there is no place for interference by any other person.

I will however say, that a very short acquaintance with the subject shows that every system which has been devised for paying labourers is liable to abuse. The payment of a stipulated sum of money for stipulated services to be rendered is, of any plan, the least so liable, and it ought, as far as possible, to be carried out.

That system which gives food, and fuel, and accommodation is the best of all, when administered with kindness : for the extras are worth to the labourer much more than the sum at which they would be valued to him in a money payment ; but it is more liable to abuse than the simple money payment. The abuse in this case affects the due reward of labour ; as, for instance, the privilege of receiving wheat at 5s. a bushel may very easily be made no privilege at all. The payment, too, of all this household stuff as wages is a thing which affects householders only, and the young men who are leaving us are those whom we want to keep. To do so, then, we must just offer wages which will keep them—wages, too, according to the work they do. This, however, is not the whole truth of the matter. The relation of master and servant is mixed up in agriculture with much beside a mere bargain for the sale of services—with much that is personal ; there is more scope for the development of kindly personal feeling between the two than there is in the case of any other class excepting household servants. Of course this personal feeling may show itself in that which is of great money value besides mere wages, and in much that is of higher value than money is capable of measuring. A young man will, notwithstanding lower wages, keep his place for the sake of advantages of greater value than the increased sum he might otherwise receive. His master takes an interest in him personally, showing it by helping forward his education, and by seeking ultimately a better position for him ; and this is soon observed and thought of. But there is a reverse side to this picture ; and just in proportion to the closeness of contact which the terms of service enforce between the two *may be* their recoil asunder as soon as they are once more free.

If there be a plan which would strengthen the bond between the two more than any other, one would imagine it to be the very common one in England of lodging the younger labourers in the farm-house, and giving them partial board as well as cash. But what is the ordinary experience on this point ? In many a parish, perhaps in the majority, Old Michaelmas-day sees an almost complete sweep of the young men and lads who have lived during the past year in the houses of their masters. The evening school each winter presents a new array of faces, and the masters are, for a while, at least, and necessarily, as much strangers to their lads and

many of their men as if they paid their wages through a clerk, and had as little opportunity of personal acquaintance as a manufacturer with his hundreds of mechanics.

It is plain that it is not in the *system*, but in the administration of it, that merit and demerit lie, and that a personal interest in the labourer as a neighbour is what will bind him to his master.

If I had in a single sentence to describe the relation of master and servant in the agricultural world, it would be to assert that nowhere is it better, and nowhere is it worse. The two are thrown closely together, and character is on both sides known, and therein lies the explanation; the two are never—as is unavoidably the case when one man pays five hundred—they are never indifferent to one another; they love, honour, and respect each other, or they distrust and hate; and while in the former case there is a noble scope for exerting a useful influence for their well-being over those who are employed, the latter in the very closeness which is the condition of agricultural service has scope enough for bringing forth its fruit.

The combination of sufficient wages with a greater scope for personal good-will than any other trade affords is what may, and often does, honourably distinguish agricultural labourers and employers amongst the multitude of English occupations.

Let me add, that the whole value of the expression to which this good-will leads arises out of its origin in a personal feeling—it cannot be deputed without altogether losing its character. Anything like the transference of my personal duty and pleasure in such a thing to a public institution spoils the whole affair.

There are local and provincial societies long established in England for distinguishing the worthy among agricultural labourers by public testimony to their worth. If that worth had shown itself in public-spirited conduct, nothing could be more appropriate than a public acknowledgment of it. When it is, however, only personal and domestic worth (far more worthy, let us admit it, than the other), nothing can be more grotesquely out of place.

These societies have, however, been established, and are supported by a real, if unwise philanthropy, and I would not say one word in discouragement of their object, however unwise may be their plan. Benevolent men have truly seen that the relationship of master and servant is but a part of the truth affecting them; and carrying the superiority of the employer over his servant into a field where no superiority exists, they have read the commandment as if it were addressed to the former only, and as if it said of the latter: "Thou shalt be a father unto him." The system of rewards for good conduct, for long servitude, and for morality, is founded on a mistaken idea of this kind. It is a mistaken idea. Along with the paternal relationship, with all its powers and responsibilities, wherever it really exists God has implanted the natural love of the father as the

safeguard of the child, and the docility and helplessness of the child as the counterpart justification of the father. Neither of these conditions applies to the relationship of master and servant. The commandment has been misread. It is really addressed to both alike, and it prescribes a perfectly mutual and equal duty in words addressed to each—"Thou shalt love thy *neighbour* as thyself."

This is the law which supplements the bare relationship of master and servant, and makes the operation of it perfect. But it is not for me to pursue the subject further, or to illustrate at any greater length to what it leads. I will only add, that the more we encourage genuine individual manliness in labourers, with its efforts after real self-improvement in intelligence and skill, and its higher sense of individual responsibility, the more likely are we to attach the young men to us, and to obtain labour of the kind of which steam power is rapidly proving the necessity. But this is not to be done either by taking all the difficulties of their position out of their way, or by offering rewards to them proper only to the qualities and condition of a child.

Let me add, that I take these remarks from a lecture read before the Society of Arts on Dec. 10, 1859, and republished in a "Handbook of Farm Labour," published by Messrs. Longman.

III.—AUTUMN CULTURE.

There is no part of the skill which the clay-land farmer needs more useful to him in his business than that which times the operations of tillage to the fit condition of the soil. Tillage operations which will benefit at one time will do mischief at another, and many a man has lamented too great activity and anxiety to get on with work upon the field which had been better left undone till the weather had improved. It is the same sort of wisdom or of folly, only intenser of its kind, which is displayed in the distribution of tillage operations through the season as is shown in their arrangement from day to day. There is a great need of fitting what is done in the field to the actual weather of the day; but there is an even greater need, especially on clay soils, of fitting the great tillage operations of the year to the average weather of the seasons.

There seems to be an advantage on clay soils in the deep and thorough tillage of the stubbles when dry in autumn, which is so remarkably greater than the advantage of the same process at any other season as almost to require some special explanation. I believe, however, that the explanation is no other than that which ordinary tillage and its influence on fertility receive; the greater effect arising from its being done in the dry and followed by the frost. But whatever the explanation be, the fact on almost every

kind of soil is unquestionable; and any means of cheapening and rendering more effective a thorough autumn tillage, and of increasing our power of carrying it out, will be welcome to all clay-land farmers.

Among such means none is so valuable when turned to proper use as a long period of dry weather after harvest. Let the ordinary means of cultivation be put energetically to work immediately after harvest during such a season as we are having (1861), and they will be better in their influence and cheaper in their cost than all that ingenuity and capital can devise or furnish for the assistance of the farmer in ordinary or in difficult times.

I am informed by a gentleman who farms largely in Holland that there the first operation on the stubbles is as deep a furrow given with the plough as can be done with horses. Ten to twelve inches of the alluvial soil are thus turned over; and if the weather permits, a cross-ploughing of less depth is given before winter. In the neighbourhood of Edinburgh nothing strikes the spectator more during a walk over the fallows in winter than the great depth of the ploughing which has been given to the land since harvest. And in instances nearer home, where the practice has been transplanted or adopted farther South, the same advantage seems to follow a deep autumnal ploughing. In the fen districts, a large deep-working plough has been lately introduced by Mr. Howard, which seems to be most influential on the fertility of the land. The bringing up a portion of the clay subsoil to be weathered during winter, when it becomes mixed with the vegetable mould of the surface, is found to be most beneficial.

And where there are no especial reasons why advantages may be expected from a similar practice, as on a comparatively light soil over chalk in the county of Surrey, yet the same advantage has followed the adoption of a similar practice. And a furrow, ten or twelve inches deep, given by means of steam power, has proved a capital preparation for the succeeding potato crop, and a capital preparation, indeed, for the whole succeeding rotation. Of course, this deep furrow cannot be given in the case of a very foul stubble; such land must be cleaned before it is safe to turn it over deeply, and it is then that modern implements are most useful.

Coleman's cultivator and Bentall's broad-share, and other machines of that class, should be put to work for the purpose of cutting off that thin surface of the soil in which the roots of creeping weeds luxuriate. The comparatively small quantity of material, in the first place, disturbed, is thus the more easily weathered, and, if necessary, burned. The harrows following the scarifiers drag all the rubbish together; and when it is either carried off or set fire to, the whole soil may be turned over deeply with the plough.

Certainly the preliminary use of the paring plough and cultivator

is a great economy. Where ploughs and harrows alone are used in tillage operations, the whole process is cumbrous in the extreme. We have seen a valuation of the acts of husbandry on a Hampshire farm, which included such items as the following :—" *Ashley Ring* (15 acres in rape)—ploughed once, six times harrowed, twice rolled. *Roller Home Field*—ploughed once, eight times harrowed, three times rolled. *Forest Coppice* (in rape)—ploughed once, eight times harrowed, twice dragged. Another part of the same field (in turnips)—ploughed three times, four times dragged, six times harrowed, three times rolled, twice harrowed after the plant was up." This was only a specimen of the twenty or more fields specified whose cultivation was described in detail. It is plain that a thorough autumn tillage would have very greatly improved and cheapened the process of cultivation as here carried out. The tenant was apparently not acquainted with the proper use to which tillage implements should be put: the harrow, as a first-class or original implement of tillage, is one of the most inefficient, and taking the power to use it into account, one of the most uneconomical farm tools we have. The drag harrow—an implement whose teeth find their way into the land simply by their weight and that of the frame-work which holds them together—is slowly drawn forwards over the fallows with labour all the greater for the straight form and number of these teeth, and with an efficiency greatly impaired by the trampling of the long team of cattle which alone can drag it along; and it is supposed to stir the soil and break up the moved land from the subsoil to the surface. This it cannot do. The scarifier and paring plough to cut the solid surface and enable us to get all weeds out of it, the plough to turn a deep and heavy furrow slice fairly over, and the cultivator and grubber to move all this already moved land, are all provided with a curved surface or with curved and forward pointed teeth enabling them to get into and under the land they have to deal with; and thus to whatever depth we work them, their maker provides for their efficiency by their form, and not by the clumsy expedient of merely adding to their weight.

A comparison of the proper office of cultivator, and harrow and plough, is made in our *Calendar* for the month of June, to which the reader is referred.

It is only necessary to add, that where clay-land is drained, the action of the cultivator across a deep ploughing done during dry autumn weather, leaves the land in just that condition in which the fertilizing effect of the air upon it will be the greatest. If the land be not perfectly, by nature or by art, drained and dry, autumn tillage should be confined after a scarifying and cleaning of the surface to a deep-ploughing in ridges: the furrows between which will give an outfall for the surface water during winter. But where land is

both drained and dry, provided tillage operations be done when the soil is dry, we need not be deterred by the thought of wet and wintry weather yet to come, from stirring and tumbling the soil about as roughly as by plough and cultivator it can be done—leaving surface water to find its way through the soil and subsoil out of the fields by the drains.

IV.—STEAM CULTIVATION.

It is at this season of the year that the advantage of steam power applied to cultivation is most apparent. If we can thus do the work of horses in the spring and autumn months, then we may dispense with them all through the year, and so save a great annual expense of keep and wages. For it is in September and October that more work of cultivation hitherto done by horses requires accomplishment than at any other time, and draught animals have therefore to be kept all the year round for the sake of their labour during a few busy months. I described two steam cultivated farms in the month of April (p. 188). As it is of importance that the reader should have before him the latest experience on this subject up to the date of our publication (Sept. 1861), I add extracts from reports of other instances which personal examination has enabled me to draw up.

1. **Bourton, near Shrivenham.**—My first is an illustration of the economy attendant on the use of steam power, especially in those cases where the labour of cultivation is unavoidably confined to particular seasons of the year.

Mr. George Pocock, of Bourton, near Shrivenham, has had one of Fowler's ten-horse engines, with his three-furrow balance plough, at work since October, 1859.

The farms at Bourton and Upper Stratton include 250 acres of arable land and 400 acres of pasture. The land is very stiff, probably on the bed known as the Kimmeridge clay. Of the arable land at Bourton, one quarter is in sheep-food—clover, and vetches, and rape—the remainder being in wheat, beans, and barley.

It is obvious that there is an immense extent of autumn cultivation, and comparatively little other work. A large extent of bean stubble has to be ploughed for wheat; clover and rape have to be ploughed for wheat; barley stubble has to be ploughed for vetches; wheat stubble has to be ploughed for beans; and all this, except perhaps the last item, which may be done somewhat later, has to be accomplished after harvest and before November. Force enough has to be put on to accomplish the work in proper time, and when the land is in the right condition, which such excessively stiff land very rarely is. And not only this ploughing, but a great work with the harrow has to be accomplished in a hurry to fit the land for the

seed, and to cover it in. When once the wheat and vetches are sown in October, and the land for beans is made ready for the seed, most of the work is done.

The fact, then, in this case is, that a great number of horses are kept most of the year for the sake of their labour at a critical time. No fewer than fifteen to twenty horses were kept on Bourton Farm; eighteen was the common number, and several teams of oxen were taken up during the latter months for the accomplishment of the work. It is, however, difficult to estimate the exact cost of horse-labour on the farm, because after the busy season several horses were always put up to fit for sale. I have therefore estimated, with Mr. Pocock's consent, the horses saved by the introduction of steam-power into the field at nine horses during six months, and six oxen during three months of the year.

Mr. Pocock purchased Mr. Fowler's apparatus in October, 1859, and the next week sold six draught oxen, and gradually parted with his horses until from sixteen or eighteen they were brought down to seven or eight. He thus saves the keep of at least nine horses during the year, and of at least six oxen during say three months of the year, when their food goes to the production of force instead of flesh. He saves the full wages of team men in both cases during the time of full work—say six months for horses and three months for the oxen, and he saves the wages of horsekeepers during the other six months. The expenditure would therefore be:—

	£	s.	d.
<i>Food.</i> 9 horses at 10s. a week	234	0	0
6 oxen at 7s. a week (13 weeks)	27	6	0
	261	6	0
<i>Extras.</i> Blacksmith, farrier, harness, &c. 2l. 2s. 0d.	18	18	0
Maintenance of value, 10 per cent. on 270l., the value of 9 horses	27	0	0
	307	4	0
To this must be added repairs of such implements belonging to horse cultivation as have been displaced by steam-power, say 10 per cent. on 100l.	10	0	0
	£317	4	0
Add also <i>Wages.</i> A man and boy to each of 3 teams during 6 months, and a man and boy to 9 horses during 6 months, and a man and boy to every 3 oxen during 3 months, at 10s. a week for the men, and 3s. 6d. a week for the boys—			
4 men, 26 weeks, at 10s.	52	0	0
4 boys, 26 weeks, at 3s. 6d.	18	4	0
2 men, 13 weeks, at 10s.	13	0	0
2 boys, 13 weeks, at 3s. 6d.	4	11	0
	87	15	0
Add interest 5 per cent. on capital, say 260l.	13	0	0
And for 3 months on 130l.	1	12	6
	14	12	6
	£419	11	6

This, then, is the cost which Mr. Pocock saves by the use of his steam-engine and cultivating apparatus. Now let us see what it costs him.

Mr. Pocock has had his rope at work for eighteen months, and though once or twice jammed by accident, it has never yet broken. He has had his engine and plough at work during the same time, and has had four sets of points for his plough, which cost him 36*s*. He has also had sundry additional expenses connected with new wheels, and one or two other little matters, but including all that, his whole expenditure on repairs has not been 20*l*.

His belief as regards the rope—costing 40*l*.—is, that one-half of it in his management will last two years, and the other half will last three years.

	£	s.	d.
It thus appears that 20 <i>l</i> . will have to be laid out every other year	10	0	0
And 20 <i>l</i> . once in 3 years	7	0	0
And thus	17	0	0
per annum covers the cost of rope; add for repairs 20 <i>l</i> . for 1½ year, or	13	0	0
And	£30	0	0
will cover the whole annual cost of repairs and rope.			

The average performance is perhaps barely five acres a day when ploughing—by a three-furrow plough worked by a ten-horse engine. The coals cost 18*s*. a ton on the land, which is close to the station, and eight cwt. a day is the ordinary consumption. The labour employed when at work is—

	£	s.	d.
Engineer, per week	1	1	0
Ploughman	0	18	0
Anchor boy	0	9	0
2 porter boys	0	14	0
Horse and water-cart and boy, say	1	4	0
	£4	6	0

Or say 14*s*. 6*d*. a day.

The wages are high, and Mr. Pocock is perfectly sure that he is well repaid in paying such wages as shall secure the content and interest of those men who are employed. To this he attributes the fact that he has had no breakage or accident since he began.

The work the engine had done when I walked over his farm since Mr. Pocock has had it, amounts to fully 900 acres, and it was a very moderate estimate of the work yet to be done which put it at 300 acres to be accomplished before the date of purchase comes round again this year. The whole work would thus be 1200 acres in two years, or 600 acres annually. The work done has been partly ploughing and partly grubbing, amounting, therefore, on the average to at least six acres daily, including removals, so that 100 days' work per

annum must be charged against the engine, and the annual cost will stand thus:—

	£	s.	d.
Repairs and rope		30	0 0
Coals, 8 cwt. at 18s.	£0	7	6
Oil, probably	0	1	0
100 days, at	0	8	6
Wages, 100 days, at 14s. 6d.		72	10 0
Maintenance of value, 10 per cent. on say 740l.		74	0 0
Interest of capital, 5 per cent.		37	0 0
The whole annual cost thus amounts to	£256	0	0

The annual cost of horse-labour was put at 419l. 11s. 6d. And even if that be reduced by one-half the charge for food for horses (234l. per annum), as they were at work during only about six months, and were then put up to prepare for sale—even then the cost of the horse-power (displaced by 256l. per annum spent upon the engine and apparatus) would exceed 300l.—so that there is a direct annual saving to Mr. Pocock by the employment of steam-power in cultivation, by which he has annually ploughed and grubbed at least 600 acres for 256l., or not much more than 8s. an acre. How much more than this the ploughing and grubbing of such heavy land cost when done by horses every farmer knows. It is customary on the extremely heavy land of that county to require six horses to every 100 acres of plough land—and the trampling of long teams in the furrow, altogether saved by steam-drawn tools, cannot but exert a most mischievous effect.

2. **Little Woodcote, Carshalton.**—Let me now take a case of an entirely different type—a light land farm upon the chalk, only 400 acres in extent, already so skilfully and economically managed that thirteen horses suffice for its cultivation, notwithstanding that there is a great deal of haulage during the year, both of produce and manure, and notwithstanding that only one-seventh part of the land is each year in clover and grass. A thirteen-horse farm, and a light land farm as well, is, one would think, hardly the place for the steam plough. Nevertheless, two years' experience of the steam plough on such a farm has amply satisfied the occupier—a tenant farmer—that his enterprise has been successful—that on the lightest soil there is a great advantage in being able to make the full use of good seasons for cultivation, and in ability to plough twelve inches deep, even though chalk and flint be every now and then thrown upwards to the surface. And he now declares that on entering a farm, even though no larger than 400 acres, and those light soil, he would as a first investment spend 700l. or 800l. on a steam plough.

Little Woodcote Farm lies—a tract of open country and light

calcareous soil of various depth—upon the chalk, about a mile from the Carshalton Station on the London and Epsom Railway. Mr. Arnot, who is in the fifth year of his lease of it, brought to its cultivation four years ago the habits, experience, and prejudices of a Forfarshire farmer; and though in several things the county of Surrey and its circumstances have since modified his opinions, yet he finds essentially that the style of farming adopted in the North answers perfectly in the South.

The rotation adopted is for the most part Scotch—no less than one-seventh of the land is in potatoes, which as a principal farm crop is new to the district. Only one-seventh is in clover; this is followed by wheat; the wheat stubble is deeply cultivated, and in the following spring the land is planted for the most part with mangold wurzel—forty or fifty acres being in mangolds, and the remainder of that seventh, ten or fifteen acres, being in turnips. The mangolds are followed by oats, and these by barley. The stubble is again thoroughly cleaned and deeply tilled for potatoes, which are followed by wheat, with which clover and grass seeds are sown.

The style of cultivation, too, is Scotch; a ten and even twelve-inch furrow in the case of all stubble ploughing for fallow crops is not a Surrey practice. The ridge system of culture for mangold and turnips—the horse culture for the potato crop—all this is more Scottish than English.

Mr. Arnot has had Fowler's ten-horse power steam-engine and ploughing apparatus since the harvest of 1859. He has thus had two full years' experience of it, though owing to its somewhat late arrival in 1859, and the wet season of 1860, he cannot yet be said to have done a full year's work. His apparatus, rope, and engine cost 700*l*. He works a three-furrow plough, and by the substitution of a subsoiler for one of his ploughs, he is able either to plough all one way, or to stir and at the same time throw two furrow slices together ridgewise.

The ploughing of the farm is almost wholly done by steam. Clovers are turned over six inches deep for wheat; wheat stubble is ploughed ten or twelve inches deep for mangolds and for turnips; these are either fed or pulled, and the land is ploughed shallow, five or six inches deep, for oats; the oat stubble is ploughed shallow and cleaned for barley; the barley stubble is ploughed twelve or fourteen inches deep for potatoes; and the potato land is ploughed shallow for wheat. Besides this an extra ploughing is sometimes needed by a foul barley stubble for potatoes; and both the potato land and the mangolds are ribbed for receiving the manure in autumn if possible. This is then covered up by the horse-plough, whose work is confined to this and to the cultivation of one or two small and inconveniently shaped fields. The work done each year by the steam plough on this 400 acre farm has thus been 393 acres in 1859-60,

and 389 acres in 1860-61. It has been done at the rate of six or seven acres a day for ordinary ploughing, and three acres a day (one acre per furrow) when at the ten and twelve inch deep work. It may average on the whole five acres a day, including all stoppages and removals, and has thus taken close upon eighty days for its accomplishment. Besides this, however, 150 acres have been ploughed during the time for neighbours, at a charge, including everything, of 12s. an acre. The engine is also used for threshing purposes, and 220 acres at home, and 250 acres elsewhere, are thus threshed out for hire.

The cost of repairs has been uncommonly small—including a new cogwheel, repacking cylinders, and a thorough overhaul and cleaning of the whole apparatus at the end of two years—besides the replacement of shares and sharpening of coulter for the plough, and the gradual wearing of the rope porters. In all it has not nearly reached 10*l.* a year, at which, nevertheless, we put it.

The tear and wear of rope is reported as follows:—A new 400-yard rope, lately bought, costing 35*l.*, has made the stock stronger and better than it was at the beginning. This charge may therefore be put against more than two years' work, and is equal to about 15*l.* a year.

The weekly cost of labour when at work is as follows:—Engineer, 18s.; ploughman, 14s.; anchor lad, 9s.; two porter lads, 6s. each; horse and water-cart, about 20s. weekly—in all, 3*l.* 13s. weekly, or as nearly as possible 12s. a day. The cost for oil is 1s. a day, and for fuel at nine or ten cwt. a day it may be put at 10s. daily. The charge for depreciation at 10 per cent. is 70*l.* a year, and for interest of capital 35*l.* a year. The whole annual cost may thus be estimated:—

Labour, 80 days	£48
Fuel and oil, 80 days	44
Repairs and rope	25
Depreciation and interest of capital	105
Total	£222

But 500 acres of threshing and 70 or 80 acres per annum of steam ploughing for hire, equal in all to at least 40 days' work per annum, are also done by this engine. And the profits of this work should be deducted from this sum before Mr. Arnot's experience of his investment can be accurately described. At any rate, the whole of the sum charged for interest and depreciation of capital ought not to be put against the ploughing. The sum of 222*l.*, at which if there had been no other use for engine and apparatus, his cost must have been estimated, is equal to 11s. per acre over the work accomplished, much of which, however, was twelve inches deep. But if the

proper share of the interest and depreciation of capital be charged upon its work elsewhere for hire, the cost of steam-ploughing will not exceed 190*l.*, or 10*s.* 6*d.* an acre. It is probable that Mr. Arnot would contend that the engine is not 30*l.* worse than when he purchased it two years ago; and one-half of this, with interest of capital, will amount to 50*l.*, two-thirds only of which should be charged against the plough-work—and 150*l.* would thus appear to be the annual cost of ploughing 400 acres, or 7*s.* 6*d.* an acre. In fact, he might very well claim that this sum should be still further reduced by all the profit of his hire elsewhere, which can hardly be put at less than 20*s.* a day, and this on forty days per annum will amount to 40*l.*, or more; so that the net cost to him of his machinery has not been more than 110*l.* a year, or 5*s.* 6*d.* an acre over his ploughing.

What did it use to cost him when he worked thirteen horses on his farm? He now works six horses. His horses get 2½ bushels of oats, and 2½ trusses of hay weekly each, during seven months:—

30 weeks at 11 <i>s.</i> amount to	.	.	£16	10	0
22 weeks on clover, &c., at 5 <i>s.</i>	.	.	5	10	0

The annual food per horse costs . £22 0 0

The annual charge for depreciation, farrier, blacksmith, saddler, and implements, is at least 5*l.* per horse, and for interest of capital in horse and implements, at least 2*l.* more. This makes the annual cost of each horse 29*l.* The wages paid, in cash and cottage, to ploughmen is at least 32*l.* per pair, or 16*l.* per horse, and the whole cost is thus equal to 45*l.* per horse per annum; which, over seven horses, amounts to 315*l.* per annum—one-half more than the expenditure, even on the highest estimate, upon the engine which has displaced them, and nearly double what Mr. Arnot has actually incurred when he deducts his profits on its hire.

We give the experience of this small light land farm in full detail, because if Mr. Arnot has found steam-power answer for its cultivation, though employing the old and smaller form of the apparatus, there cannot be a doubt of the improved and full-sized engine and machinery being a profitable substitute for horses on three-fourths of the arable land of this country.

3. **Castle Hill, near Cricklade.**—I refer to one more farm cultivated by Mr. Fowler's apparatus, because its labour is in this case contrasted with that of draught oxen, which has been displaced by it.

Castle Hill Farm is 740 acres in extent, of which about 640 are arable; it lies on the junction of several oolitic beds, and is on one side bounded by the river. The soil is thus of various quality, most of it, however, being a strong calcareous clay. It used to lie in 36 fields;

but Mr. Ruck, its tenant, has now, by the destruction of nearly 400 chains (5 miles) of old fences, thrown the land into 9 fields of 70 acres each. Formerly it was cultivated "as you could do it," but as a general rule wheat came once in three years, and fallow every three years as a general rule was also unavoidable, sometimes because you lost your chance of getting in a crop, sometimes because of the foulness of the land. Even still the weather has often beaten those who trust in the ordinary means. And thus last autumn (1860) many lost their chance of getting in their wheat. The possession of the steam plough saved Mr. Ruck's seedtime, and his wheat crop has thus this year been benefited.

The land is now cultivated, part of it on a four-years' and part of it on a five-years' course of crops; the nine fields and the varying character of the land enabling these two rotations to be adopted. The lighter land, 280 acres, is in four fields, growing wheat, turnips, barley, clover; the heavier land will be five fields, growing wheat, vetches, mangold wurzel, and sheep keep, wheat, clover, and beans manured. The clover is kept down till late in the year for the sake of the ewe flock, and is then broken up for beans, instead of wheat.

Mr. Ruck has had Fowler's steam plough since February of 1860, and has worked it with remarkable success. He had for several years intimated to Mr. Fowler that as soon as his engine would displace seven ox teams he would become a purchaser, notwithstanding that he has always contended for the comparative cheapness of ox labour; the superiority of the engine as to depth and quality of work, and its influence on the labourer, being the advantages by which he expected to be repaid.

As soon, therefore, as Mr. Fowler was prepared to displace so large a quantity of draught power by his engine, it was sent to Castle Hill. The farm was formerly worked by nine horses in three-horse teams and twenty-eight oxen. It is now worked by only nine horses, all the oxen having been displaced except one kept for the use of the shepherd.

It is, however, only fair to add, that while the extra work of drainage, enlarging fields, and making roads proceeds, more labour goes on upon the farm than will hereafter be required. In the meantime the cultivation of these nine 70-acre fields and the 100 acres of pasture is carried on by a 12-horse-power engine, and Fowler's 4-furrow plough, nine horses, and about 950*l.* worth of manual labour, besides the salary of a bailiff, and the cost of tradesmen's bills.

To understand the expenditure which has been saved, we must remember that even if, as Mr. Ruck had always argued, oxen retained their value while at work so as to cost the tenant nothing, yet there would be at least 12*s.* a week paid for every team of four during probably about thirty-five weeks of the year, and the wages

of one man to look after all the teams when not at work during the remainder of the year; and the price thus paid as wages formerly and not paid now amounts to about 157*l*. In addition to this we have the fact that Mr. Ruck is about to increase his flock of 450 to 600 ewes, partly owing to the increased fertility of the land, partly because he no longer feeds a herd of twenty-eight oxen, in both cases owing to his adoption of the steam-plough. And it is a very moderate estimate which puts the profit of the new arrangement at 200*l*. a year; so that without taking into account tradesmen's bills, depreciation and repairs of implements, and assuming that as much capital will be invested in live stock now as there was in the days of ox-labour, yet 357*l*. are added to the resources of the farm by the displacement of the oxen.

And now to understand the cost of the engine by which this displacement has been effected: I find on inquiring field by field that since February, 1860, and up till the middle of April, 1861, 555 acres had been ploughed, and 764 acres had been worked by the same implement with the scarifying breasts, making 1319 acres worked in all. This corresponds to the very large extent of at least 1000 acres per annum cultivated by the engine during the very wet and difficult year of 1860. This has been accomplished at the rate of seven acres a day upon an average, including time lost in removals, &c.; and the engine has thus been worked upwards of 140 days in the year. The fuel consumed is about ten cwt. daily, costing 10*s*. or thereabouts upon the ground, and the oil costs about 1*s*. a day. The wages per week are—engineer, 1*l*.; ploughman, 1*l*.; anchorman, 12*s*.; two porter lads at 6*s*. each; and one boy and horse for coals and water, 1*l*. 4*s*. This amounts to 4*l*. 8*s*. a week, or 14*s*. 8*d*. a day, and their wages over 140 days are about 102*l*. per annum. The fuel and oil in like manner, at 11*s*. a day, cost 77*l*.

The repairs during the period include an injury to plough and anchor from running into the anchor when working in a fog, when the signals could not be seen—a cogwheel broken out of the gearing for the forward motion of the engine—repairs of porters for the rope, and three dozen ploughshares—in all about 15*l*. The tear and wear of rope has been considerable, owing to the lower groove in the drum which carries it below the engine being cut a little deeper than the upper one; thus causing either a stretch or a grinding of the rope, by which it was broken. In all, owing to this injury, and the natural tear and wear of rope arising from ordinary use, 50*l*. are charged to Mr. Ruck: this, however, includes an additional purchase of rope; and he is thus stronger in rope now than he was at first; if, therefore, 40*l*. per annum be charged on this account, it will be a fair account of the expenditure on this item during the first year of Mr. Ruck's experience.

We have to add to these items 39*l*., being 5 per cent. on the

capital invested, and 78*l.*, being 10 per cent., for depreciation in value. And the total annual cost of the steam-plough comes out 346*l.* per annum, rather less than 7*s.* an acre.

This is certainly very much cheaper than the work can be done in any other way. The quality of the ploughing is superior to that done by horses, and most of it is good 3-horse work, worth at least 12*s.* or 14*s.* for hired labour, and probably actually costing the farmer 9*s.* or 10*s.* A saving of more than one-third the cost, and a great improvement of the quality of the work, are well worth trying to effect; they are to be accomplished, according to Mr. Ruck's experience, by the use of Mr. Fowler's engine and apparatus, even in the unimproved state in which on this farm it has hitherto been used.

4. *Stevington, near Bedford.*—I add the case of a well-known farm cultivated by steam power applied to the Woolston apparatus.

On the property of his Grace the Duke of Bedford, and on the Bedford side of the village of Stevington, on the crest and either side of one of those waves of land which the surface of the Oxford clay there presents, lies the Tithe Farm of Stevington, occupied for some years by Mr. William Pike. It is a tract naturally of poor clay soil. Its character, where unassisted by good cultivation, is sufficiently shown by certain remarkably poor crops in fields close by; and the influence of drainage and deep tillage on it is equally manifest in the superior character of the wheat and other crops on the farm of Mr. Pike.

This farm was formerly in many fields, and cultivated in narrow ridges, the only drainage of the land being by the shallow surface furrows between those lands. Since it has been in the occupation of Mr. William Pike, he has, at the expense of his late landlord, reduced the number of the fields to twelve; and from a small size, involving endless loss of labour on headlands, he has increased their size to an average of about thirty acres. He has also drained the land four feet deep, and thoroughly cultivated it by steam-power. The extent farmed by Mr. Pike has till lately been about 475 acres, of which 357 were arable; and fifteen horses were employed, in five three-horse teams, upon this extent. Now, about 600 acres are farmed, of which 420 acres are arable; and the whole is managed with ten horses and an eight-horse-power engine, working grubbers on the Woolston system. It is hardly possible to estimate the saving of the labour thus effected, because whereas formerly the horse-power of the farm was organized in so many teams, each with ploughman and boy, now there is but one man in the management of the stable, and lads or men at the ordinary wages are sent out with the horses according to the work they are engaged upon. If, however, the additional land requires the same horse-power per 100 acres as was needed on the original farm, then in place of ten horses, seventeen or eighteen must have been needed, and the cost saved is

that of about $2\frac{1}{2}$ three-horse teams, or probably 250*l.*, *i.e.*, supposing that the horses retained cost as much per head as they used to do when no auxiliary steam-power shared in the work. This, however, I do not suppose that they do, and probably Mr. Pike's mere saving by the use of his eight-horse engine and cultivating apparatus does not fall short of 300*l.* a-year.

The land is now cultivated in a general way on a six-year course of cropping, viz., (1) barley, (2) grass and clover, (3) wheat, (4) beans, (5) wheat and oats, (6) mangold wurzel, turnips, and vetches. The present cropping of the land is as follows—125 acres are in wheat, of which 105 were partly after beans, cross-grubbed by steam-power before sowing, and partly after clover, having been cross-grubbed also by steam-power more than once before the previous harvest time, and then horse scarified and harrowed. The remainder was after horse cultivation. There are 60 acres of beans after wheat, its stubble having been dressed with farm-yard dung, and then ploughed by horse-power. There are 60 acres of grass and clover; 20 acres now in vetches have been cross-grubbed after a manuring; 25 acres in mangolds and turnips have been cross-grubbed in autumn, and again steam scarified and crossed in spring; 50 acres in barley, and 25 acres in oats make up the extent of the farm, and were got in after steam cultivation.—By “cross-grubbing” it is meant that the operation was repeated.

More horse cultivation than usual was done last year (1860). Clay land was fit only on rare occasions, and both horse and steam-power were then used to the utmost. Mr. Pike has had Mr. Smith's grubber worked by an ordinary threshing engine since July, 1858. Since that time 731 acres have been cross-grubbed, *i.e.*, doubly worked. In addition to this Mr. Pike informs me that he has also cross-grubbed for hire 300 acres of land. For this he charges 25*s.* an acre, the coals being supplied to the employer.

Excluding this item from our consideration in the meantime, and assuming that 730 acres—double cultivated between July, 1858, and June, 1861—correspond to 250 acres annually, let us see what the cost of the steam cultivation on this farm is. The average performance of the engine, including all stoppages except removals, has been six acres daily once cultivated. To do 250 acres twice would therefore occupy at least eighty-three days; adding three days for removals, there are eighty-six days' work of the steam-engine to be charged upon the steam cultivation of the farm. The following is the labour and its cost per week:—1 engineer, 16*s.*; 1 ploughman, 11*s.*; 2 men shifting anchors, 22*s.*; 1 man at windlass, 12*s.*; 1 porter boy, 6*s.*; 1 boy and horse with water-cart, 24*s.*: the whole amounts to 3*l.* 19*s.*, or 13*s.* 2*d.* daily. In addition to this we add the cost of coals, 10 cwt. at 19*s.* a ton on the ground, or 9*s.* 6*d.* daily. The oil at 5*s.* a gallon costs about 1*s.* a day.

The daily cost thus comes to 23*s.* 6*d.*, and this over eighty-six days amounts to about 100*l.* Against the engine and apparatus, costing about 510*l.*, we must put 10 per cent. or 51*l.* for depreciation, and 5 per cent. or 25*l.* 10*s.* for interest of capital. The cost of repairs may perhaps be satisfied by an annual charge of 15*l.*; and for tear and wear of rope we have the following items: 1400 yards of iron wire rope originally purchased, 50*l.*; steel ropes, 1400 yards since purchased, 60*l.* Probably the annual charge needed to maintain this may be made on the theory that the rope will last three years, and 25*l.* a year may suffice for this particular. Adding up these items, we have a sum total of 216*l.* 10*s.* to be charged against the farm for steam cultivation. Putting 216*l.* against 500 acres once grubbed in the course of the year, we have a charge of about 8*s.* 7*d.* an acre for the grubbing. And there are two additional considerations in favour of steam power: (1) that if there had been a larger farm this steam-power would have displaced a much larger number, and consequently much heavier cost of horses. This is plain from the fact that Mr. Pike has done 100 acres of cross cultivation each year for hire, besides the cultivation of his own farm: and if two-fifths of the cost of rope, repairs, depreciation, and interest be deducted because 200 acres have been annually one-way grubbed elsewhere, for every 500 acres done at home, then the charge upon the farm will be 170*l.* a year, or less than 7*s.* an acre for the work. And (2), there is the principal fact of all steam cultivation, that its quality is superior to that accomplished by horse-power. Mr. Pike informed me that during the three years of his steam cultivation, on several of the ten fields already specified he has not used the plough at all. Even the mixing of manure with the soil is done by the grubber. No plough is used to bury it. It is laid upon the land, and grubbed to and fro, and thereby mixed sufficiently. The cleanness of the land, too, is a fair testimony to the quality of cultivation by implements which stir, but do not overturn the soil.

Mr. Pike has till lately used the grubber invented by Mr. Smith, of Woolston, with the turnbow apparatus for turning the tool at the land's end. Latterly he has used the cultivator of Messrs. Howard, each tine of which is double, pointing both fore and aft, so that no turning at all is needed, the claw which follows in the wake of the working tooth as it goes coming into operation in its turn as it comes back again. The windlass is Messrs. Howard's new one; the rope and anchors are the same as have been long in use. The engine is stationary in the middle of the side of a long rectangular fifty acre field, beside a pond, from which it pumps its supply of water. The rope goes from it right across the field to the middle of the opposite side, and there the tool stands; it works between that point and one end of the farther side, and the anchors are shifted backwards along that end

and along the midway line of the rope, which travels round a triangle formed by the position of the windlass and the straight furrow of the grubber which parallelly approaches the engine side of the field as the work proceeds. The other half of the field is done in like manner, and were another such field to lie on the other side of the engine, 100 acres could thus be done without ever shifting its position. Two thousand yards of rope or thereabouts would, however, be required; and we have yet to learn the amount of draught which the mere to-and-fro movement of the amount of rope takes out of the power of the engine, but the rope is kept well off the ground by extra porters.

These four cases, in addition to those given in the earlier pages of this volume, must suffice as proof that steam cultivation, as now practised both on Mr. Fowler's and the Woolston system, is an agricultural success. We must refer for drawings of the two forms of apparatus promised in page 189 to plates at the end of the volume. The following must suffice as description of the two systems respectively:—

(a) In Fowler's case, as already partly described at page 189, an engine moves along one headland and an anchorage moves along the opposite headland, while between the two, and looped around a horizontal sheave or drum on each, a wire rope stretches. The ploughing apparatus is a link in this rope, and the engine is worked alternately, so that this link is drawn to and fro between the headlands. The tool is on a frame balanced on the axle of a pair of large wheels and carrying three or four ploughs at either end, facing one another. On reaching the further end of the field the working end is lifted, and the other being depressed, comes into operation on the return journey. The two ends of the draught rope, carried respectively round the anchor-pulley and round the clip-drum under the engine, meet on the plough-frame and are there respectively wound on two small drums and tightened, so that a few rope-porters in the length of the furrow carry most of it off the ground. This tightening or slackening has hitherto been done by hand, and a good deal of delay has been the consequence. Now it is done by connecting the two drums together, so that the pull upon the foremost drum tends to wind up the other. A certain fixed fraction of the draught thus always goes to keep the rope tight, and a great many economical consequences follow. There is (1) economy of time, for the delay of winding up or letting out slack was of serious consequence. (2) There is economy of the rope itself, for it is now lifted off the soil, and but little wear in consequence ensues, and many acres probably could now be ploughed before the rope would lose its coat of paint. (3) There is economy of power, for the drag of the rope on the ground not only wore away the rope itself, but it exhausted the power of the engine. Wire

rope of the size used for a four-furrow plough takes more than one cwt. per 100 yards to drag it along. (4) There is an economy in the matter of breakages and repairs, for if the plough should be brought up upon a landfast rock, instead of the brunt coming simply on the draught rope, which would either snap or pull the framework of the plough to pieces, it is, through the pull of the one drum upon the other, immediately spread all over the field wherever the rope goes; and being distributed over every bearing which the rope affects, it is more likely to be borne uninjured. And lastly (5), there is an economy as regards the general efficiency of the engine, for it is precisely this constant and uniform tautness of the rope around the sheave beneath the engine which enables its ingenious clip-groove to do its work in holding the rope without slipping. The arrangement adopted by Mr. Fowler is indeed now almost entirely automatic. And instead of a large number of hands, the ploughman (whose mere weight in his seat effects that connexion of the two drums on the plough-frame to which we have been alluding), the engineer, a boy to attend the anchor, and a couple of porter lads to shift the bearings of the rope as the plough comes up, are all that are needed to the working of the apparatus. The anchor, too, is now no longer bound to move only in a straight line; a very neat and simple arrangement for guiding the disc wheels enables the anchor-lad to guide it along a tortuous headland, and the engine may move of itself along a similar one opposite to it, and the self-acting slack gear on the plough will let out or take up rope corresponding to the varying length of the furrow between the two.

One of the most ingenious of Mr. Fowler's recent adaptations of the engine is in the case of the ordinary eight-horse-power threshing engine. It is stationed at a corner of the field and there made to actuate a clip-drum on a frame-work, which abuts upon and is tied to that of the engine; and around this clip-drum the rope passes and is taken to two moving anchorages at either end of the plough-furrow. The rope thus surrounds a triangle, and the anchor movement being put in gear whenever necessary, both anchors move along the headlands while the plough goes to and fro between them. The diminishing length of rope as the furrow approaches the point where the engine and the clip-drum stand is of course taken up by the self-acting slack gear on the plough; and nothing can be more quiet, business-like, and satisfactory than the process.

(6) In the arrangement adopted by Mr. Smith, the engine is separate from the drum or windlass on which the rope is coiled, and drives it by a strap, or, as in Mr. Howard's modification of it, by a shaft and universal joint. The rope winds and unwinds on the two drums alternately, and the rope which goes from them round

the four sides of the unploughed part of the field draws the cultivator or the plough to and fro between the two headlands which are the sides at either end. The anchors are shifted bodily by a man at either end of the plough furrow, so as to suit the new position which on every return of the tillage implement the furrow occupies. That windlass which is out of gear rests (in Mr. Howard's recently patented form of it) on its inner rim on a block of wood which is a self-acting drag upon it, so that the rope from it is paid out reluctantly, and the other windlass then in gear has thus not only to pull the plough home, but also to unwind its reluctant neighbour. There is, however, an advantage in this, inasmuch as the rope is thus kept tight and so lifted off the ground from porter to porter. In addition to the to-and-fro grubber already named as used by Mr. Pike (every tooth in which is forked, facing both east and west, each coming into work alternately as it is drawn to and fro along an east and west furrow), Mr. Howard has now in use a very ingenious frame of ploughs resting on wheels at either end. Two or three ploughs below, and two or three above, are slung upon a horizontal axle between these wheels. The axle itself is lifted at the end of the furrow, and one half turn being given to it the upper ploughs descend and come into work on the return journey. The ploughman has easy control over the position of this axle, and can lift or depress it as he chooses while it is at work. He can also easily guide the wheels, and so regulate the breadth of the land which his ploughs are taking at a time. The main difficulty in the perfect operation of the ploughs depends on the wheels which support it at so far apart. If the ground were level this would not be a difficulty, but wherever not a perfect level, then the plough may be almost lifted out of work at one time while it sinks deeply into the soil at another. Accordingly, in the award of the judges at Leeds, the fitness of the implement for level land was especially alluded to.

In Fowler's plough, which is supported on a single pair of wheels immediately before the ploughs, this difficulty is hardly felt at all.

The most prolonged trial which steam culture has yet received was given to it at the Leeds meeting of the English Agricultural Society (July, 1861). During ten days or a fortnight the gentlemen appointed as judges by the Society were engaged on light land and on clay land with dynamometer and watch, and weights and measures, in determining the relations of performance and expense. Their award ultimately was as follows:—The 100*l.* prize offered for the most economical application of steam-power to the cultivation of the soil was awarded to Mr. Fowler for his twelve-horse-power engine, moving anchorage, and plough; and of the 100*l.* offered for

the most economical application of the ordinary threshing engine of the farm to steam cultivation, 75*l.* was given to Mr. Fowler, and 25*l.* to Mr. Howard.

As a last word on the subject, let us add that the experience hitherto published or realized of the steam plough is, no doubt, of two kinds. That it is all favourable to steam cultivation is not true. Men can be found who have not yet succeeded in applying steam power profitably to cultivation, on either method of it. Breakages, accidents, delays, have added to expenses and taken from performances until the quantity of work accomplished has not been more than at the same expense could have been done as well by horses. It is probable that there are many men who will never use steam power profitably. They have not got the requisite patience, skill, or resolution; and, on the other hand, there are doubtless some with energy enough to have been among the first to undertake steam cultivation, and with natural ability enough for anything, who have not yet given time and superintendence enough to train their men aright, and who accordingly have had little else but disaster to record.

We have travelled over many steam-cultivated farms during the past summer (1861), and have seen some failures and many successes. The most striking of the latter have been in instances where the purchaser of the apparatus has himself worked with it in the field from morning till night for the first few weeks, and until he had thoroughly trained his men. "I cannot charge the machine with 10*l.* for repairs, although I have had it for two years; but then I never left it while the fire was lighted for a month after it arrived." This was the reply in one case to our inquiry. And it is plain that unless the farmer is determined in this way that the apparatus shall succeed, it will probably be a failure.

But besides personal difficulties in the way of success, there are others connected with the condition of the locality. As Mr. Fowler stated at the meeting of the Gloucestershire Steam Plough Company, the clearing of the fences is the real point upon which rests the pecuniary success of the process. "If he had a steam plough, and a person asked him to plough a seven-acre field, he would not go near him; but if he wished him to plough fields of twenty acres, he would do the work. The whole question of steam ploughing depended upon the question whether the fences were cleared or not. So much time was lost in shifting and arranging the tackle, and making fresh adjustments, in small fields, as to make it impossible for the men to get on. If landlords gave leave to tenants to clear the fences, and tenants would not clear them, he would not plough their land; and if the landlords would not give leave to the tenants, he would serve them in the same way. The one requisite of large fields was all that was required. If the fences are to remain as

at present, it is not possible to do it, except at a cost considerably greater than that of horses. The cost of steam ploughing is entirely a question of clearing those beggarly fences. If people will have game instead of good farming, steam ploughing must go to the wall."

When fields of thirty or forty acres shall be the rule, steam ploughing will be common and everywhere successful. If, on the other hand, small fields and wide and crooked hedge-rows are to be continued, then we must be content to cultivate our land with horse-drawn implements.

Lastly, supposing that neither personal nor local difficulties exist, there is the question—Whose apparatus shall I purchase? In the case of large farms of 1000 acres or more, where twenty or thirty horses are employed, and twelve or fifteen may be got rid of, and still leave enough to do all the carriage of the farm, we believe that Fowler's full-sized apparatus, twelve-horse engine, and four-furrow plough, is the best that can be used. In the case of small farms, Howard's or Smith's apparatus may be the best to use; and certainly we have seen perfect success, both agricultural and economical, attending both on many farms throughout the country.

V.—CROP CULTIVATION.

This, in the month of September, includes wheat-sowing, and the sowing of winter beans, both of which, however, may be, and generally are put in during the following month. *Trifolium* should be sown now if not already in; and winter vetches should also be sown immediately. Rye, as yielding the earliest spring green food, should have been sown in August, or even in July. It may, however, well follow a corn stubble, which should be scarified, harrowed, and cleaned, and then receive a dressing of farm manure, which is ploughed under. Three bushels of rye per acre are then sown broadcast and harrowed in. On clay soils winter vetches are a better crop. On light sandy soils rye is preferable.

Of vetches we give the following account extracted from the somewhat enthusiastic essay on their cultivation given in the first edition of this work:—

The author of this essay feels both pleasure and pride in having been the first person who raised them on a large scale, and publicly recommended them to the notice of agriculturists. In 1821, after thirty years' experience of their utility, it is difficult for him to say more in their favour than they deserve. But he takes leave to observe that they may be made one of the principal means of enabling the arable farmer to support as much live stock as the grazier. For during the time they occupy the ground, they produce as much green food, of the best quality, per acre as the richest grazing land; and the ground may be cleared of them in such good

time (in June) as to admit of raising a clean crop of either turnips, cole, or cabbages on the same soil in the same year; or in lieu of any of these plants, if the soil be infested with couch, that may be eradicated, and the land sown with wheat in October; or even after the crop of either turnips, cole, or cabbages have been cultivated and removed, the same soil may be prepared and sown with either wheat, barley, oats, or pulse. By this arrangement three valuable crops may in any place be obtained every two years.

Vetches, if not cut too green or given fresh, are good food for horses, and they will fatten sheep and bullocks; they are excellent for promoting the secretion of milk in cows, ewes, and mares; they suit every situation and flourish on almost every variety of soil; they do not depend on any particular market; and, above all, if folded on the land with sheep, they manure the land fit for the immediate production of turnips or cole, whereby a succession of green crops can be kept up, that will fatten an increased quantity of live stock, and be the means of adding to the manure of the farm. A rotation of vetches, turnips, cole, cabbages, and other green crops may with perfect ease be made the means of rendering all arable land as rich as can be desired.

Vetches are good food alone, but they are particularly useful as following Swedish turnips or cole in fattening ewes and their lambs; by which the latter may be sold to the butcher in the months of May or June, and the ewes in September. In this manner the whole flock may be fattened and cleared off within the year, and thus make room for a fresh stock of store ewes to be fed, as well as their lambs reared, and both fattened annually.

Winter vetches cannot be sown too early after the corn harvest is finished, though they are generally sown at any time during the latter half of August, the whole month of September, or the first half of October, and in a mild season they will bear sowing even a fortnight later. If the soil be poor, or the situation elevated and exposed, sow in August; and upon every farm it is advisable to sow some of them early and others late, in order to have a succession of green food the ensuing summer.

Spring vetches produce rather a lighter crop than the winter sort, and are subject to more risk from a dry summer. There is no difference in their use or value per ton; but the spring sort coming to maturity two or three weeks later, makes it convenient and advisable to grow some of each, in order to have a succession of them for green food all the summer. They may be sown all the spring and summer from February till the middle of July, but the success of late sowing will depend on a showery season.

Immediately after corn is carried from a field, or even part of a field, in August, or early in September, scarify and cleanse whatever of them, having no clover or other seeds among them, may be intended.

for vetches. Cart on it such manure as can be spared, up to 10 or 15 tons of well-rotted dung per acre, and spread it, sowing the vetches upon it; these (the seeds and manure) should then be immediately covered by the thin and narrow slices of a very small plough. Or what is generally better, plough in the dung, give the land a slight harrowing, and then drill the vetches in rows six or eight inches apart. If ploughed and pressed, and then sown broadcast, a very light harrow, or if the soil be friable, even a bush harrow may close the seams. These operations will cost about ten shillings per acre. But where no manure is used, the seeds may be harrowed or scuffled in without ploughing, at so small a charge as one shilling per acre.

A proper quantity of seed is three bushels of winter tares alone, or two bushels and a half of tares mixed with half as much winter barley or rye per acre.

After the seed is covered, cleanse the water-furrows, in order to render the land dry during the winter. And in the following March, when the soil is dry, roll it just enough to smooth the surface, for more conveniently mowing the full-grown crop. If any docks, thistles, or other large weeds should rise, have them drawn by hand, and carried off the land.

The crop should be left till it begins to blossom, which may be expected to take place about the middle of the following May. Then the vetches may be daily mown and carted to sheep and cattle of all sorts in their sheds and yards; or they are served to sheep in cribs hurdled off, or they are folded upon the land where the crop has grown. It is well when they are mown and given to horses to let them wither after cutting for twenty-four hours before letting the horses have them; as when very young and succulent they are physic rather than food.

The land from which vetches have just been taken will be found in a good state for being immediately prepared for, and sown with, the seed of either turnips or cole; or for being set with the plants of either cole or winter cabbages.

It is perfectly clear that the crop more than repays every expense of obtaining it, by the manure derived from its consumption, and by the improved condition of the soil.

It is suitable for almost every sort of soil, but particularly so for clay, owing to coming to perfection in June, when it may be either eaten in cribs upon the soil, or carted off, without fear of poaching. And after the crop is off, there is time enough to cleanse the soil, and sow it with wheat in the best possible condition, certainly in as good condition as after a whole year's fallow.

Wheat.—Sowing and reaping used perhaps more commonly formerly than now to be carried on together; and the young wheat had often indeed appeared before wheat harvest was com-

pleted. This was the case especially with wheat sown after fallow and with wheat sown after clover and grass. Such fields are in the southern counties, either after a second cutting has been removed, or after a hard pasturing of the field, manured with dung from the yards which has been lying in heaps since spring, and is now carted on and spread broadcast at such a rate as the quantity allows, and ploughed under with a shallow furrow. If ploughed with a skim-coulter so as thoroughly to bury the green surface and whatever lay upon it, and afterwards pressed with the drill presser, and then suffered to lie for a month before sowing, every condition likely to secure a crop is observed. There is plenty of manure and of "heart" in the land, and it receives and acquires a good firm texture which the wheat plant likes. The land lies in ribs sufficiently abrupt to ensure that seed sown broadcast and harrowed in shall fall into the lines opened for it and come up in row as perfectly as if drilled.

Wheat after a bare fallow is sown by the Suffolk drill in rows from eight to twelve inches apart on land which received its last ploughing some weeks before. And it is then harrowed in and the ground left—the rougher the better. Six pecks of wheat, or less, is ample seeding in the month of September. And that quantity is also sufficient when sown broadcast either skilfully by hand, or by machine, over a ribbed ploughing, and harrowed in so as to come up in lines.

The following memoranda on wheat-sowing in September are given from the original edition of this work:—

Seed-time.—Upon all cold, wet, and backward soils, September is the best season for putting in wheat, provided the land be not too dry; for wheat should never be sown in a very dry season, nor till rain falls in tolerable plenty. Upon drier and warmer soils, it is far better to postpone it till October. But in this case every agriculturist should remember, that the soil intended for wheat should be cleansed and prepared for it in September, by scuffling and destroying all root weeds, as well as ploughing the soil once into ridges, the most suitable for keeping it dry through the following winter. Another general observation is, that in proportion to the earliness of the sowing a small deduction may be made from the accustomed quantity of seed, as two bushels sown any time in this month are equal to three in November.

Steeping seed.—There are many methods of steeping, brining, and liming seed wheat, and they are all intended to prevent the smut. Many experiments on this object have been made, from which it appears that steeping wheat in a solution of arsenic gave clean crops from extremely smutty seed; though a shorter time in the steep than twenty-four hours was not quite effectual.

James Ellis, Esq., of Barming, near Maidstone, Kent, prepared seed wheat for sowing by dipping it in boiling water and afterwards

in cold water, and then mixing it with lime. This method has secured his crops of wheat from redgum and smut, and it is said from mildew, for many years. Mr. Ellis provides a copper of a suitable capacity for the purpose, and nearly fills it with water, which he raises to a boiling heat, and into it he dips a basket containing about a bushel of wheat, which is stirred about and continued in the boiling water about a minute, in which time all the grains and other matters which float are skimmed off. The basket is then lifted out of the boiling water, and immediately dipped into cold water in a rather large vessel placed near the copper, where it is again stirred and skimmed; in this place it remains about another minute, and from thence it is poured upon a floor, where one person sifts quick lime upon it, and another mixes the lime and wheat together, till every grain becomes coated white, and then it is deemed fit for sowing.—It is proper to add, however, that this is a cumbrous, and tedious, and doubtful process, and one which has long been displaced by other simpler and more efficient methods, described further on. Nevertheless, Mr. Young's remark is most important, that it is scarcely possible to be sufficiently upon one's guard against the wonderfully subtle germs of smut or bunt.

The importance of clearly understanding that the distemper arises solely from contact with this infectious powder is very great, as without this conviction, no man will be sufficiently attentive to his barn floor, his screens, sieves, and every implement that comes near his wheat; and, above all, his sacks, an article that has communicated smut to thousands of acres; floors are swept into farmyards, and the dung contaminated; in a word, if the attention be not perpetually alive to every possible circumstance that can communicate infection, the consequence of one sackful of infected wheat may be felt on the farm for many years, and yet the common system of brining and liming be regularly performed.

Wheat after beans.—Beans, if well cultivated, form a tolerable preparation for wheat; I have seen in Kent a field of wheat, which, as an experiment, was made to follow four preparations, namely, beans, clover, tares, and fallow, and the first was superior to all the rest; next the clover, then the tares, and the worst was after the fallow. If the bean stubble be clean, a paring implement or broadshare will cut through everything, and loosen the surface sufficiently to enable the harrows to leave it as clean and fine as a garden, women attending to pick and burn. In other cases the scuffler or cultivator will do it better than the other implement. When the surface is clean and pulverized, either drill or sow the wheat broadcast; in the latter case it may be covered either by a harrow, the scuffler, or a very small plough. On a tenacious soil, there need be no apprehension of wheat becoming root-fallen from a loose bottom, but a new surface will be brought up that may be difficult to drill.

If the soil be more loose and friable, and the fine surface which the operations had obtained be ploughed down, it will give the wheat too loose a bottom, and there will be a chance of a root-fallen crop. In such cases, or in any that have a tendency to this circumstance, do not plough at all, but either drill directly or sow broadcast after the soil has been pulverized and cleansed by the scuffler; the seed may be covered by the same implement, which will save tillage, and obtain the probability of a larger produce. This is a new practice on strong land, but I have seen such success in it as leaves no reason for doubting the soundness of its principle. It should be remembered, that whatever other circumstances may influence the growth of this grain, it loves a firm bottom to root in, and rarely flourishes where it is loose and crumbly, nor will a depth of such mould do unless the under stratum, in which it will attempt to fix its roots, be firm and fertile. The best basis is well-cultivated earth, firm from not having been lately disturbed.

Wheat after clover.—Clover forms so good a preparation for wheat, as to yield ample crops at very little expense: so much so that, while the Norfolk husbandry, of 1, turnips; 2, barley; 3, clover; 4, wheat, is practicable on land dry enough for turnips, and rich enough for wheat, the agriculturist may well be satisfied with his profit. But after long repetition, it has been found that two evils gradually appear, which were unknown at the first introduction of it. Turnips now require ample manuring where they were once produced of larger size with little; and the clover has become so subject to failures, that it is no longer easy to have it every fourth year. This has created the need of variations, but still retaining clover as the preparation for wheat. The husbandry, however, was very imperfect, from the mode of putting in the wheat, which was merely by the harrow after ploughing, in which method (for the skim-coulter was unknown) the seed was too apt to fall into the seams of the furrows. The practice of dibbling was an improvement; in this method the seed was deposited in the centre of the slice, the regular treading which the land received pressed down the furrow, and gave a degree of firmness not otherwise attainable. The success was great; and had the labouring poor continued the accuracy which they began in dibbling, the practice would never have lessened; but they have done it of late years in so careless a manner, that drilling is everywhere coming in. We may mention here that various seed dibbles, depositing eight or ten sets at once, and greatly diminishing labour, have been invented; in particular one going under the name of "Sigma's," manufactured by Mr. Powell, near Tonbridge Wells. Nevertheless, it remains true that the practice of drilling is now almost universal in England.

Where the practice of dibbling remains, the land having been ploughed a fortnight or three weeks, is rolled down with a heavy

roller, and then dibbled : it is then to be bush-harrowed. Six pecks of seed are enough for two rows on a flag in this month. And another observation it is necessary to make, that if the land is known to be predisposed to mildew, an increase of seed on that account is right, whatever the soil or season ; by reason of the well-known fact, that all thin crops suffer more from that distemper than such as are thicker.

A very singular experiment of Mr. Duckett's, on preparing a clover lea for wheat, should here be mentioned. He had a field in which wheat rarely escaped being greatly root-fallen : not to lose sowing it with that grain, and at the same time to guard against the malady, he scuffled it repeatedly, till he had torn up the clover, and also gained tilth enough for the drill ; then he collected the clover fragments, and carted them into the farm-yard to make the bottom of a dung-heap, and drilled the field. The wheat in this case having obtained a firm bottom in an unstirred soil, escaped the disease, and yielded an ample produce. The clover root, which would have produced the dreaded looseness had it been turned down, made a large quantity of dung, and therefore was not lost to the farm, though the particular field was deprived of it. No saving of expense was here made, but an extra one incurred ; but it secured a crop where otherwise there would have been none. This treatment is especially needed where there is much rye-grass among the clover. Indeed, unless a rye-grass stubble be thus thoroughly disintegrated and fallowed, it is one of the worst preparations for the wheat crop that we have.

Wheat after tares.—A good crop of winter tares leaves the ground in such loose, rotten, and friable order, that on clayey soils it is in excellent condition for either green crops or wheat. But sandy land may be too loose after tares for wheat, and in that case it is much better husbandry to sow turnips, or plant potatoes on it, than prepare it for wheat. However, if the farmer should determine to sow wheat after tares, the soil should be cleansed and pulverized by the scuffer, the couch and rubbish should be burned, and the ashes spread, in which state, if the surface lies in such ridges as will keep the soil dry the following winter, the wheat may be either sown or drilled without any ploughing. This has been practised with good success, and it is peculiarly suitable for either light or strong land.

With such cautions on the part of the agriculturist as are before mentioned, wheat succeeds very well after either clover, tares, beans, cabbages, potatoes, or turnips.

We propose now to add further remarks here (1) on the so-called "pickling" of wheat for seed as a preventive more especially of smut ; and (2) on the importance of selecting as seed grain which has been specially grown for that purpose.

1. On Pickling Wheat.—Mr. Berkeley's remarks on this sub-

ject have been already given at p. 397. We shall add here those of the late Professor Henslow, in the second volume of the "English Agricultural Society's Journal:—

Upon the careful preparation of wheat for seed depends, to a considerable degree, the value of the future crop. Several diseases to which the plant is subject are believed or known to have their germs resident in the seed or on its surface, and to remove these should always be the object of a careful operation at seed time.

The two diseases, to avert which is the main object of steeping and otherwise preparing seed wheat, are the smut and bunt or pepper-brand; in the latter, which is the more dreaded of the two—because the grain retains its form and appearance in the sample—the parasitic fungus which produces it has a peculiarly fetid odour; in the former this smell is wanting, and the seed-vessels burst, dispersing their sooty contents before the general ripening of the crop. Smut is more common in oats than in any other grain crop.

It has been known long before those who adopted the practice possessed any definite idea of the cause of these diseases, that the best method of avoiding them was thoroughly to cleanse the seed. Botanists have since informed us that the success of this operation is owing to its removing from the surface of the seed the germs of those fungi to which these diseases are owing—germs of inconceivably small size—not above $\frac{1}{1600}$ of an inch in diameter—so small, in fact, that they are absorbed by the root of the young plant.

The following passages are extracted from Professor Henslow's report. Referring to the bunt or pepper-brand, he says:—

"Upon simply immersing the grain in water, the infected seeds float, and on the water being poured off nothing but the sound ones remain in the vessel. This simple process, however, is never perfectly effective, because in threshing the wheat, many of the infected grains (smut-balls) are crushed, and the spores are dispersed in the form of a fine powder, which adheres with considerable obstinacy to the surface of the sound grains, by means of an oily or greasy matter found in the fungi. In order to detach them thoroughly, it has been considered useful to add some alkaline ley to the water in which they are washed; because oil and alkali unite and form a soapy substance, and then the spores will no longer adhere to the surface of the grains of wheat. Lime, possessing alkaline qualities, has been long employed for the purpose. Common potash, and substances containing ammonia, as the liquid portion of stable manure, have also been used. But as some persons employ brine, sulphate of copper, arsenic, and a variety of other materials which do not possess alkaline properties, it is supposed that all

these solutions act rather by destroying the vegetative properties of the fungi, than as a means of removing them from the surface of the grains. It may therefore be worth while to institute a set of experiments to determine which supposition is really correct. Perhaps some portion of the effect may be owing to the increased specific gravity of the liquid; or perhaps some portion of the solution may be imbibed by the steeped corn, sufficient to prevent the sporules of the fungus from germinating within the substance of the plant; just as corrosive sublimate, essential oils, and Russia leather, prevent the formation of mouldiness. I may also add that the temperature at which the solutions are applied may be of some importance."

In the section "On the precautions to be taken against bunt and smut," a suggestion is offered which we think well worthy the attention of farmers. Professor Henslow says:—

"From a variety of considerations, it has always appeared to me strange that practical agriculturists are accustomed to pay so little attention to the raising of pure seed-crops. There may be reasons which I do not properly appreciate, that would render it inexpedient to cultivate a seed-crop apart from the rest of the produce raised on a farm; but I should have thought that it was always worth while for every farmer to set aside some portion of ground to be more carefully tended than the rest, for the purpose of securing good and perfectly clean seed. Among other reasons for such a practice, he would then be able to weed his crop from every plant infected with bunt or smut, before the fungi ripened."

It is certainly the interest of the farmer either to do this or to purchase his seed from those who pay particular attention to its cultivation.

We shall make only one more extract, in which a series of experiments are recommended with the view of ascertaining what substances in solution are the most effectual preventives of these diseases. These are published here, as being likely both to lead the practical reader to a useful conclusion as regards his own practice, and also to encourage the habit of investigation generally.

"A parcel of thoroughly bunted or smutted seed should be divided into a number of small packets, each of the same weight; or if very small, each containing the same number of grains. When any of these packets are steeped or washed, the floated grains and the fungi which rise to the surface may be kept apart for separate experiments, being carefully labelled 'F. 1,' 'F. 2,' &c., to show that they were obtained from the packets of seeds, 'No. 1,' 'No. 2,' &c. by this process.

No. 1. Seeds unwashed, to serve as a comparative experiment.

„ 2. Washed in cold water only—(2*), in scalding water.

„ 3. Washed in water with lime, the proportions specified.

No. 4. Washed in water and brine.

(a) Mixed in the proportion of 2 water to 1 saturated brine.

(b) " " " 1 " 1 "

(c) " " " 1 " 2 "

(d) Saturated brine.

„ 5. Washed in sulphate of copper.

„ 6. Sprinkled, but not washed, with lime.

“Another set of experiments may be prepared with clean corn, to be infected with the floated fungi obtained in washing the above.

No 7 rubbed with—

(a) F. 2, to serve as a comparative experiment.

(b) F. 3. (c) F. 4. (d) F. 5.

“Another set may be prepared with clean corn, which should first be steeped in different solutions, and then rubbed with the fungi obtained by simply washing in water (No. 2).

No. 8. Steeped in lime, and rubbed with F. 2.

„ 9. „ brine and do.

„ 10. „ sulphate of copper and do.

“These last may be repeated by washing the seeds clean after they have been steeped, to remove any of the mixture that may here adhere to the *surface*.”

In addition to brine, blue vitriol, &c., Glauber's salts, the sulphate of soda, has been recommended to be used just as the sulphate of copper, and then dried with lime, which decomposes it and leaves caustic soda on the surface of the grain, to deal with and destroy the life of the fungal germs which may cling to it.

We may add the following report of *experience* on this subject, which is taken from a statement made some years ago by Mr. David to the Cardiff Farmers' Club.

“In November, 1822, I selected three bushels of wheat, which I had grown that summer, and which was exceedingly smutty, but to render it still more so, I had a quantity of smut-ball rubbed into it, until the whole was much blackened. The lot was then divided into six half-bushels, and having dissolved half a pound of blue vitriol in boiling water, the wheat was pickled as follows:—

No. 1.—Immersed in the vitriol water for three hours.

„ 2.—Washed and skimmed until it was clean, then immersed in the vitriol water as above.

„ 3.—No preparation.

„ 4.—Washed and skimmed well until clean.

„ 5.—Washed and skimmed as above, then sifted quicklime over it, and mixed a quarter of a pound of salt with it.

„ 6.—Pickled in the mode usually adopted, with a mixture of lime, salt, and water.

“The seed was sown the following day on a clover lea, in six separate ridges, each 112 yards long, by 4 yards wide, half a bushel to each ridge, being at the rate of near five bushels per acre. (!)

Nos. 1, 2, and 5 came up thin, seemed to be at the rate of only two bushels per acre.

No. 6, appeared to be at the rate of about $2\frac{1}{2}$ bushels per acre.

„ 4, appeared to be at the rate of about 3 bushels per acre.

„ 3, appeared at the rate of about 4 bushels per acre.

“Sept. 5th, 1823.—The whole was reaped, each lot being carefully kept separate, and the result proved as follows:—

No. 2.—Found only two smutty ears in the whole ridge, which, notwithstanding the care taken, might have come from an adjoining ridge.

„ 1.—Had several smutty ears in it.

„ 5.—From 30 to 40 black ears in the ridge.

„ 6.—About a 20th part smutty ears.

„ 4.—About a 5th part smutty ears.

„ 3.—About one-half smutty ears.

“From which it appeared that the blue vitriol, coupled with washing and skimming, proved to be an effectual cure, even to a sample of the description sown. Ever since, I have invariably used vitriol, and have found, from twenty years' experience on upwards of 100 acres of wheat annually, that one pound to a sack of wheat will prevent the disease, as I have never had smutty wheat since. I believe the cure was effected in the above by destroying the vegetative powers of the damaged seed, for it will be observed that the produce was clean in proportion to the thickness of the plant.”

We have only to add that we have found the use of blue vitriol (sulphate of copper) to be perfectly efficient, though at the rate of only half a pound per bushel. But to add quicklime to the wheat after having steeped it in this solution, as was done in one of the above trials, is entirely erroneous. Lime will decompose sulphate of copper, and to add it to the wheat after steeping it, as above, would, therefore, be an attempt to neutralize the benefits which are expected from the use of that substance for this purpose. The recipe is as follows:—Dissolve half a pound of blue vitriol in a gallon of warm water in an earthenware vessel, and pour it over a sack of wheat on the barn floor, and turn it over and over, so that every grain shall be thoroughly wetted. It will be dry and ready for sowing in two or three hours' time. Do a sack at a time, and do not have too much done beforehand, as it is better that it should not lie long in heaps before sowing.

2. **As to choice of sort.**—Remarks upon the alleged advantage of a change of seed are given at page 136. We only add here a word in corroboration of Professor Henslow's recommendation to buy seed of seed growers—*i.e.*, not in the general market, but of those who really select the parents of their seed and offer what may be called a pedigree wheat. All selected and carefully grown wheats may be called pedigree wheats, and as such, no doubt, are as likely to transmit their valuable characteristics to the plants as are animals

which have inherited their characteristics through a series of preceding generations. Of the fact that when qualities are inherited from parents they are likely to be handed down to children, there can be no doubt. When inherited through a sufficient number of generations, the probability becomes a certainty. Take the history of the "Duchess" tribe of short-horn cattle as an illustration of this point. We give it here because there seems no reason to doubt that in this case the analogy between animals and plants, *e.g.*, between a short-horn and a wheat plant, is sound and real:—

—* More than half a century ago, when Charles Colling's herd was sold, a young heifer, named Duchess, was bought by Mr. Thomas Bates, of Kirkleavington. From her has descended a tribe of short-horns known as Duchesses, which are believed to possess all the leading merits of the breed in extraordinary degree. In particular, they are possessed of a remarkably soft and silken touch—of abundant hair and other indications of vigour—of most symmetrical form—great and equal width of back, well arched-ribs, and prominence and width of bosom. Several of this tribe were exhibited at Leeds, (1861), and they were almost uniformly successful. Duchess 77, a three-year-old cow, which has carried off the first prize in her class whenever she has been shown, was first this year in the most remarkable class of cows, that has probably been ever got together. Duchesses 78 and 79 (twins), the one a roan and the other a white yearling heifer, at the Canterbury show last year, and then placed first and second in their class, were here shown in a very first-rate and numerous class of young cows, and they again occupied the head of the list. And it is not only in the pure-bred Duchesses that this extraordinary merit appears, but wherever a cross of the same blood has been given it appears to have unusual influence, and most of the prize-taking and commended animals owe their successful position at Leeds to influence of this kind. This is one of the results of what is called in-and-in breeding. Animals which have inherited again and again in the course of their pedigree the qualities which relationship in blood has conferred in common, possess those qualities much more energetically than others do in whom they are observed for the first time. A cross-bred ram may have a very desirable coat upon his back, and a very well-made carcase of mutton within that coat, but it is exactly a toss up whether his progeny acquire the character of his sire or that of his dam. If sire and dam for generations back have exhibited constancy and uniformity of character, then that character is certain to reappear in their offspring, which in his or her turn will possess still greater power of transmitting good tendencies to the following generation. It is thus that not only in the Duchess blood, but in other tribes descended from the Kirkleavington herd, we have as the result of

* *Oxford Journal.*

Mr. Bates' resolution, patience, skill, and constancy, qualities which reappear in generation after generation until an animal may now be safely characterized as good if known to be of Bates' blood. Bates' blood, or rather Bates' *brains*—for it is the mental, and, in many important particulars, the moral character of the breeder which is reflected in now so many different herds—is merely another word for patient persistence in breeding from animals of a given type, in great measure disregarding the question of relationship, if they possessed the requisite health and vigour of constitution. Of course, when evils of any kind are inherited, as a tendency to disease or weakness of any kind, breeding in-and-in will intensify and hand that down with as much certainty as any other quality; but the natural law of breeding, which obtains amongst gregarious animals where the strongest sire is the father of the herd or flock—to the almost entire disregard of previous natural relationship—is a safe one to follow. It is a natural law of this kind that gives to particular herds and flocks where they have been long under the control of one man their uniformity of character from year to year. The thing is as true in flocks of sheep as it is in herds of cattle; and Mr. Jonas Webb's flock of southdowns, which has just been scattered (1861) by the auctioneer to all lands, will no doubt perpetuate and extend the influence of Mr. Jonas Webb's skill and character just as widely as those of Thomas Bates are felt on both sides of the Atlantic at the present day.

Now apply this analogy in the history of animals to the case of the wheat plant.

During the past autumn (1861) Mr. Hallett, of Brighton, has offered to the public what he calls a pedigree wheat. He makes use of this analogy from the history of short-horn breed of cattle in the following way:—

“It has been the great leading idea of my life, that the starting with an accidentally large ear is a very different thing from starting with a similar ear the result of descent, or pedigree. Take the case of two heifers identical in every respect but pedigree—the one what she is by accident, the other by design; the one worth 300*l.*, the other 25*l.* From the former you may get any imaginable kind of progeny, from the latter only a good kind; in other words, you have fixity of type. And the good qualities gain the force, as it were, of impetus, by continual accumulation.

“If a farmer wants a good turnip, his instinct leads him to select a good parent—the same with regard to animals, horses, cattle, or dogs—but the moment he approaches the cereals he no longer adopts the principle which he knows in other cases to be right.

“Is the trouble it would be the cause of this? Let us see. From one grain planted in September, 1859, I shall this year, September, 1861, drill forty acres. A whole ear in 1859 would have

planted eighty times as much. Now all farmers should be continually trying this as a matter of business, employing any kind of wheat they think likely to suit their purpose.—I do not say that my wheat is the only wheat that can be thus improved; far from it. All wheat may be improved, though not to the same extent. I merely say that I can offer them the only wheat at this present moment in existence which has been so ‘bred’ for years successively, and that if they prefer to pay me for the trouble I take rather than do it themselves, they can with one bushel, costing less per acre for seed than common wheat, grow enough in one year to stock their farm, and may by purchasing a bushel annually replenish their stock with a generation more advanced.

“If planted early in September one peck will resist wireworm more successfully than eight pecks in November. The plants are, in fact, as inaccessible in March and April to the ravages of wireworm as are ordinary crops in June and July.

“But rational seeding requires also that it be done at a rational time—it is as wrong to employ two gallons per acre in November and December as two bushels per acre in August or September.”

We saw Mr. Hallett’s crop when growing. The following was the statement of quantities given during harvest time. There were three plots:—

No. 1. A 10-acre field—not planted until the end of October on account of the wet season (1860), which was fully six weeks too late for the quantity of seed employed: viz., 10 pecks on the 10 acres—produced 1861, 57 bushels of wheat and 140 trusses (of 36 lbs.) of straw per acre.

No. 2. An 8-acre field—drilled 20th November, 1860, with 6 pecks per acre—produced 1861, 54 bushels of wheat and 112 trusses of straw per acre. Both these fields were occupied by root crops (manured in the usual way) in 1860, and the wheat was put in without any further manure or special preparation whatever. It is, however, impossible to get the wheat in in proper time after roots.

No. 3. A garden plot, where seed had been dibbled, one to every square foot, at the rate of $4\frac{1}{2}$ pints per acre.

The soil is light and shallow, resting immediately upon the chalk, and the usual crop of wheat is from 32 to 36 bushels per acre—40 bushels being considered a very good crop.

Mr. Hallett has, in the beginning of this month (September, 1861), drilled about 30 acres with about 30 pecks, using the small turnip-cups of the seed barrel of Garrett’s drill: this is now (Sept. 30) well up, and the plant as thick as could be wished.

His own statement is to the following effect:—“I never thought No. 1 a success, *i.e.*, what I call a success, but 57 bushels is a very great crop for my land. I can show you a field of 7 acres now up,

the whole of which was *one grain* two years ago. One acre of it was in *one ear* this day one year ago."

It is plain that the whole subject of wheat improvement is, at Brighton, in the hands of a very observant, intelligent, and energetic man. It is now the fourth year since Mr. Hallett commenced the careful cultivation of the wheat plant. Commencing with an ear of nursery wheat four years ago, he has year by year selected most carefully the produce of the finest ears as seed for the next year's crop, and improving every successive harvest, he has at length more than doubled the size of the original ears. What a careful register he has preserved of all his doings—how intensely the influence of "individual oversight and care" has been exerted—is plain from the plan before us of his experimental plot, where the position of every seed, the number of ears the plant derived from it has yielded, and the value and history of particular ears are recorded. The thing which is of immense agricultural value is that a "pedigree" wheat will hand down the character of its ancestry—for if through a number of generations good qualities have been exhibited, those qualities will be certainly handed down—the produce making an effort to develop them, even in unfavourable circumstances.

It is this special care and superintendence of the growth of seed that is recommended by Professor Henslow. Many agriculturists have for years given this care. To no one is modern agriculture more indebted in this way than to Mr. Patrick Shirreff, of Haddington, who is well known as the introducer of many new sorts of wheat. We mention Mr. Hallett's name in particular, having been this autumn particularly interested in the record he has left of his proceedings. But any of our readers possessing his resolution, patience, and powers of observation, and those equally displayed by Mr. Shirreff in this work, may realize their experience for himself. We shall next month have further remarks to make on wheat-sowing, and on the sorts known to English agriculture.

Beans.—The growth of winter beans has increased of late years in this country. They ripen early, and thus not only afford opportunity of a fallow before the seed time of the wheat crop which follows them, but they are thus also less liable to the attacks of mildew and aphis, which often make their appearance on spring-sown crops later in the season. They seem also especially adapted to a lighter class of soils than has hitherto been considered fit for the bean crop, and may thus be taken instead of pease or other crops less valuable than themselves, and suitable for light land culture.

The common culture is to scarify a wheat or corn stubble of any kind, and harrow whatever couch or other rubbish there may be in it, and burn it. Then cart on whatever manure you may be able to

spare for it, and it is the experience of Mr. Lawes that the poorer kinds of farmyard dung—such as are made from the litter of store cattle—will do as well for beans as dung of richer quality. After twelve to fifteen tons of dung has been thus spread broadcast, it is ploughed under and the land is harrowed. Two bushels of the small winter bean are then sown by the Suffolk drill, with the levers of the seed coulters well weighted, so as to make a deep furrow. And they are thus sown in rows from eighteen inches to two feet apart. A harrowing after the drill completes the operation.

We may add that winter beans are proper for the practice of what is called “double culture.” Bean soils are very suitable for growing parsnips on, and they may be sown in February, in intervals between the rows of beans. Suppose the land to be already ploughed and manured—draw the plough through it at intervals alternately of eighteen inches and six feet—in the furrows sow beans, and cover them by harrowing the land down; then drill your parsnip seed in early spring on the thus furrowed land as shallow as possible, by means of the Suffolk drill (first mixing about five lbs. of the seed with the number of bushels of sand which the machine is set to sow), in rows eighteen inches apart, two in each of the wide intervals between the beans, and cover by bush harrowing. Let the rows be north and south, for the sake of a uniform distribution of daylight. Or the beans may be sown by themselves in this manner, and the intervals left for carrots to be sown in April. The interval of six feet is wide enough for the effectual cultivation of the land.

Potatoes.—A thorough autumn cultivation of the land for next year’s potato crop, is a great security for the produce. This is to be done first by such cleaning operations, whether a forking by hand where couch and thistles are in patches, or a uniform paring, harrowing, and burning of the surface, where that is necessary, as shall get rid of perennial weeds. Following this may be a thorough manuring with the dung cart, and a ploughing followed by the subsoil plough, which shall at once cover the manure and stir the subsoil. This is proper for those cases where the potatoes follow a corn crop, which in general they do. But it is likelier to raise a healthy crop if they follow a manured green crop, as, for example, turnips fed off in autumn on the land where they grew. If a good crop of such roots has thus been grown and consumed, all that is necessary is to plough and subsoil plough at the same time, and leave the land till spring; spreading some guano and superphosphate at the time of planting the sets, as the only additional manuring which the crop receives.

The principle of deep and thorough culture with liberal treatment as to manure, is sufficiently well illustrated in the practice of

Mr. Dixon, of Witham, Essex, who thus describes his plan. In the first place he depends a good deal on thorough autumnal cultivation, and that is why we refer to his experience now.

He double forks the land to the depth of sixteen or eighteen inches—it is commonly a wheat stubble—and he throws the lower spit uppermost. He begins as soon after harvest as he conveniently can, finishing the work, if possible, before Christmas. The soil is then left in a rough and cloddy state, exposed during the winter to the frost, snow, and atmospheric influences. In the following spring, so soon as the land is sufficiently dry, and will work into a fine mould, he harrows once, then sows three bushels of salt to the acre broadcast, and he proceeds to open the drills or furrows five inches deep, and one yard apart, with a triangular hoe. He places the sets in these furrows, fifteen inches from set to set. He then sprinkles over them one and a half cwt. of guano, mixed with ten or eleven bushels of burnt earth or ashes, to the acre, and he covers over with a common hoe; he usually plants about five acres. No horse labour is employed except for the one harrowing; he plants whole tubers of a uniform size, neither large nor small. The quantity required for an acre is about fourteen cwt. The subsoil of his land is partly tender brick earth, some of it strong loam, and occasionally chalky marl and gravel. Whatever it may be, it is thrown upon the surface, and in it the potatoes are planted, and the crop has proved the better where the soil is strong. The cost per acre has been:—

Double forking	.	.	.	.	£4	0	0
Sets, per acre	.	.	.	.	2	16	0
Guano and salt	.	.	.	.	1	4	0
Harrowing	.	.	.	.	0	0	6
Planting	.	.	.	.	0	16	4
					£8	16	10

When the plants show three or four inches above the soil, taking advantage of dry weather, they are moulded up on both sides, forming a ridge eighteen or twenty-four inches wide. This work and weeding cost about 10s. an acre. Taking up the crop and storing it will be about 30s. more, making the whole expense 10l. 16s. 10d. He commenced this system of double forking in the autumn of 1854, and the crop was 416 bushels per acre; since then it has yielded great crops of turnip seed, wheat, clover, wheat, and barley, so that it is naturally a very fertile soil; but it is on these fertile soils that the potato disease is generally most virulent, and if Mr. Dixon escapes, and yet grows heavy crops, as he assures us that he does, his practice is worth copying.

We may conclude our reference to potato culture with a passage abridged from a lately printed paper, by Mr. Fyfe, of Dorchester, in which the various methods proposed for the mitigation or prevention of the disease are thus enumerated :—(1.) The first of these remedies is that of Mr. Miles, of Bristol. He states that in all potatoes affected by the disease there is to be found a degree of moisture in excess of that appertaining to sound potatoes, even before the disease is visible to the naked eye. This gradually increasing, the disease appears. Then follows the story of the Russian Professor (Bollman, of St. Petersburg), who accidentally overdried some seed potatoes sent him, from having placed them on the back of a stove, and forgotten them till the planting season. Shrivelled as they were when planted, they flourished to such a degree that, although every other potato in the country was more or less affected by disease, they were entirely free from the disorder. This put the professor upon the plan of stove-drying his seed potatoes—some of them till nearly charred—but they grew, and although in 1855 the disease was general, not one of the professor's potatoes was affected. The experiment is said to have been repeated annually, with the same results ever since.—(2.) Mr. Miles also notices that by constantly raising new varieties of potato from seed, the ravages of the disease would seem for a time capable of being evaded, as in the case of the fluke kidney, which, for the first two years after its introduction and general cultivation, was free from disease.—(3.) The next recommendation was contained in a letter read before the Royal Agricultural Society, February 20 (1860), from Mr. Leonard Short, gardener to John Mildford, Esq., Coaver, Exeter. He stated that when he found the leaves of his potatoes diseased, he immediately covered them entirely with earth, leaving the roots high and dry, the ridges being not less than thirty inches apart. The consequence, he says, is that every tuber remains perfectly sound, without spot or blemish. This he suspects may arise from the exclusion of atmospheric influence as well as moisture. Whilst digging as healthy potatoes as ever grew, he has found that some planted a few feet distant, but not earthed up, were decayed and useless. This treatment he asserts to be equally applicable to all kinds of soil and potato, and to fields as well as gardens, and he quotes an experience in defence of his statement, extending over several years and several acres. Those who hesitate to adopt this method implicitly, may at all events try the experiment on a scale of greater or less magnitude.—(4.) Finally we have the suggestion of "C., Hornsey." He assumes it to be demonstrated, that the disease is due to the deposition by the atmosphere of a minute fungus, "which, taking up its habitation upon the leaf and haulm of the potato plant, propagates with astonishing rapidity, and ultimately finds its way to the tubers and completely destroys them." He experimented for a counter-

active, set his potatoes in double rows instead of single; the two rows occupying a foot in width, with a foot of vacant space outside each row. They were planted on the level, and hoed up at the usual time. Now comes the important step; when the haulm had reached its full growth, about the 1st of July, he turned it over right and left towards the vacant spaces, by adding earth between the rows and pressing down the haulm so as to drive it from the erect position, and allow the rain, instead of descending to the roots, to run off upon the vacant space. He planted Regents and Flukes: one portion of the Regents on the old system, and a larger portion on the new—the Flukes entirely on the new. The land was a heavy clay, as bad as can possibly be for potato growing. On the new system, however, the Regents proved a good crop; on the old plan a complete failure; of the Flukes (an excellent crop) not one in a hundred was bad, although his neighbours for miles around lost their crops without exception. Others have tried the plan and proved its efficacy. A gentleman planted a lot of potatoes, and being lumbered with a lot of planks, for which he had not room, allowed them to be thrown down on part of the potato bed. On afterwards removing these and digging the potatoes, he found to his surprise that those on which the planks had lain were in excellent condition, whilst those exposed in the ordinary manner were diseased. By turning down the haulms he believes that the fungus is washed off the plant—not downwards to the tubers, but into the naked soil, where it perishes for want of nutrition.

To these may be added the suggestion of Dr. Lang, in his pamphlet reprinted from the *Journal of the English Agricultural Society*, that a certain depth of earth over the tubers as they grow will ensure their safety. The main features of his plan are these. The potatoes are to be planted in drills 24 inches apart; the sets to be inserted 4 inches deep, and 15 inches apart. Lime and salt in certain proportions are used as manure. And as one of the most effectual preservatives against disease, the plan alluded to especially advises “repeatedly earthing the potatoes up with fine earth.” We give the method, because it has repeatedly succeeded in Dr. Lang’s hands, and notwithstanding its failure, as reported by the Rev. J. Vincent, of Exbourne, in the *Bath and West of England Society’s Journal*. He says: “My crop was very much diseased, probably one-third of the whole crop. The plants had been carefully earthed up time after time, some of the drills three times, and a few, by way of experiment, four times. And it is a positive fact, especially noticed by the labourers who dug up the whole crop, that the drills which were four times earthed up were less productive than those which had been earthed up only three times. And as regards the lime, I tried lime and salt on some of the drills, and dung on others. Where the lime was, the potatoes were a trifle less diseased,

and less in number; where the dung was applied, they were rather more diseased, but certainly more in number, so that the produce of sound potatoes was about equal."

We only add, that autumn culture, by which the soil is made as fertile as possible, and the selection of sound sets—dried in autumn in the sun, and spread thinly over a floor, so that their first sprouts shall not be broken off—*whole* sets, of a medium size, planted far enough apart, and chosen from a healthy crop, of a sort new to the locality—these will together prove the most probable security for a healthy and abundant crop next year.

Rape may be transplanted this month into a well-manured, cleaned, and ploughed stubble, from seed-beds sown in early summer. Laid three or four inches apart, and covered by every second furrow, as the land is ploughed, they will yield a useful crop in the end of winter and early spring.

Mangold Wurzel.—It is the practice in some districts, during September and October, to strip the lower leaves of forward mangold wurzel, and carry them to cows and young stock in yards. The idea is, that a considerable quantity of useful cow food may thus be obtained; the removal of this leaf, it is alleged, not stopping the growth of the root. The analogies of other cases would lead to the conclusion, that as long as the leaf was green it would be useful to the root, while after it had withered it would be useless to the animal. Experiments, instituted by Professor Buckman, resulted in a corroboration of this analogy, for in every case the stripped roots were smaller than those left untouched. The experiment referred to twelve roots grown direct from seed and twelve roots transplanted, in the case of as many as nine different roots of beet. The following tables, given in the *Agricultural Gazette*, report the results:—

Weight of 12 Non-transplanted Roots.

No. of sorts.	Sorts.	Leaves intact.	Leaves stripped.
		lbs. oz.	lbs. oz.
1	Elvethan Mangold Wurzel	8 10	5 4
2	Yellow Globe Mangold Wurzel	9 0	5 2
3	Red Globe Mangold Wurzel.....	8 2	6 12
4	New Olive-shaped Red Globe Mangold Wurzel	11 13	7 6
5	New Olive-shaped Yellow Globe Man. Wurzel	16 13	12 3
6	Sutton's New Orange Globe Mangold Wurzel	9 5	3 12
7	Improved Long Yellow Mangold Wurzel	19 0	9 11
8	New Long White Mangold Wurzel	15 0	7 8
9	Silver Beet	16 15	5 9
	Total.....	114 10	63 3

Weight of 12 Transplanted Roots.

No. of sorts.	Sorts.	Leaves intact.	Leaves stripped.
		lbs. oz.	lbs. oz.
1	Elvethan Mangold Wurzel	14 10	5 10
2	Yellow Globe Mangold Wurzel	13 0	6 14
3	Red Globe Mangold Wurzel	15 4	7 3
4	New Olive-shaped Red Globe Mangold Wurzel	12 4	5 6
5	New Olive-shaped Yellow Globe Man. Wurzel	11 14	7 10
6	Sutton's New Orange Globe Mangold Wurzel	10 2	5 9
7	Improved Long Yellow Mangold Wurzel	15 10	11 1
8	New Long White Mangold Wurzel	12 11	7 6
9	Silver Beet	15 13	6 11
	Total.....	121 4	63 6

It is plain, therefore, that the practice is not one to be recommended.

Grasses and Clovers.—These, for permanent pasture, Italian rye-grass for a crop, either of that alone or sown with trifolium, and mixtures for mending blank patches, whether in clover or in grass fields, may be sown during wet weather in August and September. The method is described at page 205, and notes are there given of the various grasses and mixtures proper for various circumstances. Drawings of these grasses have yet to be given, but must still be postponed till another month.

Of other details of cultivation, it may suffice to speak by reminding the reader of the propriety of forking out patches of couch grass and other weeds wherever they appear, whether in young clover or in clover stubbles about to be ploughed up for wheat. Blanks in clover may be filled up by sowing *Trifolium incarnatum* over them, and harrowing in. Or if the patches are large and frequent, by ploughing them up, and sowing winter vetches in them.

The manuring of grass lands and of young clovers should be done this month, while the ground is dry. Well-rotted farm-dung, spread broadcast, and well brushed in with Cartwright's chain-harrow, is the best dressing that can be given to either old grass lands or clovers. If bonedust be applied, it may be given now. It is best rotted, for a month or two before, in a heap with sand, and soaked with liquid manure. It will now dig out an easily broken-down mass, and may be mixed with more dry earth, and spread broadcast out of a cart, such a quantity as contains about two quarters of the bonedust per acre. If the land is drained, the winter's rains will wash it into the ground, and the grasses, and especially the clovers, will show the advantage of the dressing next year. All autumnal dressings of manure are wasteful, except when the land

to which they are applied is naturally or artificially drained. A mere surface drainage is, for such purposes, worse than nothing. Open "grips" in the surface, as on many a clay-land meadow in the county of Gloucester, are in the case of undrained land, merely a plan by which rain is enabled the more readily to wash away the soluble fertilizing matters laid upon the surface.

During early September, a second cut of clover is, if not cut green for forage, ready for mowing and making into hay, which is generally a practicable and often a profitable thing in the south of England. Towards the end of the month, the blossom having withered, and its seed ripened, clover is cut for seed. It is usual to mow the second cut for seed, as it comes more evenly into blossom and maturity together. The crop is mown and made as hay, and stacked away in readiness for the tedious work of threshing and winnowing which is necessary for the separation of the seed.

Lime may be applied either on clover before ploughing for wheat, or on stubbles for a succeeding grain crop; and it is perhaps better to choose those stubbles, either wheat or oats, which have followed a grass or clover crop of the previous year. It is when lime is applied to land containing a good deal of vegetable matter undissolved that it is especially likely to act as a preventive of the finger or toe disease in turnips. And if added, therefore, to a stubble after clover, it is in the best possible circumstances for ensuring a vigorous growth of turnips next year. It is then, in its degree, of the same kind of utility as it is known to be when applied shortly after old sward has been broken up.

Whatever may be the theory of the subject, there is no doubt of its almost universal fertilizing influence in such a case. Everybody is aware of this fact, but that they are ignorant of its explanation is evident, by the great abuse which is generally made of the practice. There can be no doubt of the *money* value to the farmer of a knowledge of agricultural theory. From the use and abuse of lime as a manure we could bring many illustrations of this. Whether the necessity for its application arises from a faulty texture of soil, which it would correct, or from the presence of noxious acid compounds, which it would neutralize; whether it would act by inducing the formation of useful organic or inorganic compounds in the soil, or simply and directly by supplying an absent element of food for plants; the merely practical man, who is ignorant of its theory, necessarily makes in every case the same acreable application, and is thus very probably, at the very time that he may be boasting of the superiority of practice over theory, guilty of that which to his more intelligent neighbour appears in the one case as parsimony and in the other as extravagance.

Probably it is better for newly broken-up land to remain unlimed for two or three years *except under special circumstances*,

for it is already sufficiently fertile, and the expense for some years is unnecessary; and the application would probably cause an excessive fertility, if one may use that expression, such as would injure grain crops by an excessive growth of straw. Land which has borne a clover and grass crop for one or two years is not, however, thereby made so full of fertilizing matter, and may be limed very properly after bearing one corn crop. The special circumstances to which we allude occur in cases (1) where light land on a ferruginous subsoil has remained long under stagnant water. The soil is then found to contain compounds of iron injurious to vegetation, which are decomposed by an application of caustic lime, and the elements of which, under the influence of that application, are induced to re-arrange themselves in forms no longer injurious. And (2) in cases where, as an effect of stagnant water, peat has been formed, which, when drained, leaves a soil destitute of the mineral elements necessary to fertility; lime and clay are then necessary applications.

The farmer, independently of all theory on this subject, will be perfectly safe in remembering that where lime has not hitherto been applied, and where the land contains an excess of vegetable matter, or has long been injured by stagnant water, or is destitute naturally of calcareous matter, then, whatever the mode in which it acts, lime is sure to have a fertilizing influence. Apply lime, therefore, a year or two after breaking up your grass lands, and then maintain the fertility thus produced by growing each year on half the land crops for consumption on the land, by selling only grain and butcher-meat off your farm, and by bringing on to it oilcake and other food for cattle, sheep, and pigs: you will thus enrich your manure and increase its quantity.

Further remarks on the application of lime to the soil will be found at pages 305—313.

Flax, when dry and in the rick, may have its seed separated and sold to those who do the after handling of the straw, which perhaps is the best plan, as a general rule; so much so, indeed, that it is only in those districts where establishments on Schenk's, or some other quick hot-water plan of retting the flax-straw, and thus converting the crop, that it is worth while growing flax as a farm-crop. When flax is handled at home, it is taken either from the field, or, if at this season, from the rick, and the seed is beaten out of it with a beetle on the floor, and then it is steeped, as thus described by Sir Donald Campbell, Bart., in the Highland Society's Transactions:—

“The quality and colour of the flax depend much on the mode of steeping; and the strength of the fibre may be injured by an injudicious mode of performing this operation. A certain fermentation or incipient putrefaction is excited by the steeping, which must be

carefully watched, and stopped at the right time. The usual mode of steeping is to place the bundles of flax horizontally, with a covering of straw, in shallow pools or ditches of stagnant water, keeping them under by means of poles or boards, with stones or weights laid upon them. The method adopted by the steepers of Courtrai, where steeping flax is a distinct trade, is different. The bundles of flax are placed alternately with the seed end of the one to the root end of the other, the latter projecting a few inches; as many of these are tied together near both ends as form a thick bundle about a foot in diameter. A frame made of oak rails, nailed to strong upright pieces in the form of a box ten feet square and four feet deep, is filled with these bundles, set upright, and closely packed. The whole is then immersed in the river, boards loaded with stones being placed upon the flax, till the whole is sunk a little under the surface of the water. The bottom does not reach the ground, so that the water flows over and under it. There are posts driven in the river to keep the box in its place, and each steeper has a certain portion of the bank, which is a valuable property. The flax takes somewhat longer time in steeping in this manner than it does in stagnant and putrid water, where nine or ten days generally suffice; and it is asserted by those who adhere to the old method that the flax loses more weight. But the colour is so much finer, that flax is sent to be steeped in the River Lys from every part of Flanders. When it is supposed that the flax is nearly steeped sufficiently, which depends on the temperature of the air (the flax being sooner steeped in warm weather than in cold), it is examined carefully every day, and towards the latter part of the time, several times in the day, in order to ascertain whether the fibres readily separate from the wood the whole length of the stem (which may be done by taking a few plants and twisting them round the fingers). As soon as this is the case, the flax is taken out of the water; even a few hours more or less steeping than is necessary will make a difference in the value of the flax. If it is not steeped enough, it will not be easily scutched, and the wood will adhere to it. If it has been too long in the water, the strength is diminished, and more of it breaks into tow. The bundles are now united, and the flax is spread evenly in rows, slightly overlapping each other, on a piece of clean and smooth grass which has been fed off close. Fine weather is essential to this part of the process, as rain would now much injure the flax. It is occasionally turned over, which is done by pushing a long slender rod under the rows, and taking up the flax near the end which overlaps the next row, and turning it quite over. Thus, when all is turned, it overlaps as before, but in the contrary direction. It remains spread out on the grass for a fortnight, more or less, according to the weather, till the woody part

becomes brittle and some of the finest fibres separate from it of their own accord. It is then taken up; and as soon as it is quite dry, it is tied up again in bundles, and carried to the barn to be broken and hackled at leisure during the winter."

Green manuring.—Even so late as early in September white mustard may be sown, twenty lbs. per acre, on any light soil well moistened with recent showers. It will sprout at once and will yield a useful growth of vegetable matter for ploughing in during November, and thus supply vegetable matter to the soil, fertilizing it for next year's green crop, which will thus be the more likely to yield abundantly, though dependent afterwards only on a dressing of superphosphate or other artificial manure.

Odds and ends.—Fences may be switched over and trimmed; docks and stubbles drawn in pastures; tussocks of rough grass mown over; ditches and ponds cleaned out; roads mended; materials for roadmaking and for drains carried to where they will be wanted. Threshing of corn will commence soon after harvest. It is referred to at page 42. The straw as there described may be at once cut into chaff and stored away.

Let us quote under this head memoranda made during successive weeks of September, on a Hampshire farm, which give a picture of actual farm management under energetic and intelligent superintendence during this month in the south of England:—

Fine weather has enabled us to finish harvest by carting the last of the bean crop on September 3rd. Showers have greatly assisted the green crops, carrots, swedes, mangold wurzel, which are all growing luxuriantly, and promise a heavy crop where sown early. The horse labour on the farm for the past fortnight has been ploughing, harrowing, rolling, &c., land which we have since seeded down for permanent pasture, carting manure on to lea-ground for wheat, harrowing in trifolium seed, ploughing for winter tares, horsehoeing late swedes and turnips, carting the remaining portion of our oats and beans, scarifying and harrowing the bean and pea-land, preparatory for the sowing of wheat. Odd horses are kept continually employed carting hedge trimmings, border cuttings, grass and weeds after the scarifier, earth for cattle pens, hurdles for removal of sheep, clover and swedes for the cows and young stock, and sundry odd work which, for decency and appearance sake, is at all times necessary. The labourers, since harvest work, have been employed trimming hedges, cutting grass round the field borders, hoeing turnips, filling manure carts, turning and heaping manure, sowing grass seeds for permanent pasture, and sowing with them twelve bushels of bone-dust, two cwt. of Peruvian guano, and one and a half cwt. of gypsum per acre, broadcast, and harrowed in with the seed; they have also been threshing oats, barley, and the second

crop of Italian rye-grass seed, and thatching and trimming the corn-ricks. Our work during the next week or two will be taking up the potato-crop, sowing tares, carting the manure out for wheat, and ploughing the heaviest of the lea-ground for wheat, the early ploughing of which we have always found very advantageous to the wheat crop. Our mode of managing the manure made on the farm, the whole of which we accumulate for the wheat-crop, is not to draw it together in a heap and turn it before laying out, but keep it in the farmyard until required for use. We find when manure has never been heaped and turned, it being only in a partial state of decay, its effect upon the young plant is not so immediate as that of manure completely rotten, which is liable to make the young plant too gay and forward during the winter months; whereas the endurance and prolonged action of partially decayed manure is most beneficial, because it affords a gradual and continued supply of nourishment to the plant during the whole time of its progress towards maturity; there is also great economy in applying manure as above stated, by saving the expense of one extra carting and turning.

Our shepherds are but little employed with the sheep, but now take a part in the general work of the farm. We continue to feed our fattening ewes with beans and oilcake, and with two changes of pasture-grass and white clover per day. We would here remark upon the great and beneficial effects produced by the feeding of sheep with beans and oilcake upon poor sand-land pasture, which, eighteen months past, was covered with moss and sour grass, but now looks most luxuriant, with an abundant crop of good and sweet herbage. The women have been employed chiefly during the past fortnight in making a second cut of grass and clover into hay; also in couching, hedge-trimming, and pulling weeds among the swede turnips.

VI.—LIVE STOCK MANAGEMENT.

Horses are again in full work, and should receive liberal allowances of food—oats (2 bushels), beans ($\frac{1}{2}$ a bushel), and clover mixed with hay (*ad lib.*) weekly—and they may be got gradually to consume roots in place of the clover. Carrots, swedes, or mangold wurzel, all of them are good stable food. An occasional steamed mess of swedes with $\frac{1}{4}$ chaff and a little barley, is a useful meal for them.

We gave, at pages 58 and 284, a tabular statement of weekly rations for farm horses, adopted in a number of stables during winter, spring, and summer; we now add a similar list for the autumn months.

Stable Feeding during Autumn.

Name and Address.	Hay.	Oats.	Beans.	Clover, &c.	Weekly Cost.	
	lbs.	lbs.	lbs.		s.	d.
W. Gater, Botley	168	63*	32*	.....	12	0
W. C. Spooner	112	84	24	.....	11	0
T. Aitken, Spalding .....	.....	37½	.....	ad. lib.	7	6?
T. P. Dods, Hexham.....	.....	37½	35	ad. lib.	10	0?
" " "	.....	105	.....	ad. lib.	10	6?
" " "	ad lib.	105	.....	.....	10	6?
A. Ruston, I. of Ely.....	ad lib. ½	84	10	Straw. ad lib. ½	9	0?
				Bran. ½ bushel.		
A. Simpson, Beauly	168	70	14	24 lbs.	10	0
H. J. Wilson, Mansfield	.....	52½	.....	Straw. ad. lib.	7	3?
" " "	42	87½	.....	ad. lib.	9	0

We shall next month give an abstract of facts relating to food and other expenses bearing on the cost of horse power; meanwhile we give here a condensed report of a useful paper on stable management, lately (October, 1861) read by Mr. Womack before the Hexham Farmers' Club. His remarks relate to the rearing and the feeding of farm horses:—

1. For the rearing of young horses it is necessary that farmers have enclosures or conveniences for letting their colts run out during fine winter weather, or an open shed in their pasture, where they can receive their allowance of corn and hay, and at the same time be sheltered from the inclemency of the weather. Nothing can be more pernicious to horses' feet than the heat arising from litter, to which colts are subjected when fed and reared in yards and boxes.

2. There is no principle of greater importance in horse feeding than the liberal feeding of foals during their whole growth. They ought to have a due proportion of cooked food when they are changing their teeth. The plan of manger feeding, that is, giving crushed oats and beans, cut hay and straw, mixed together, at the time they are changing their teeth, would prevent their becoming reduced to the low state we sometimes see them at that period.

3. Having got the young horse so far advanced as to be able to stand full work, it is now the object of the farmer to feed him economically and to the best advantage. The provender should be the best the farm produces, for this is ultimately the cheapest; and as great a variety of provender should be given mixed together as is compatible with economy, and the quantity of each kind should be

* In this table the * means that the grain is crushed or ground.

regulated according to the amount of nitrogenous matter contained in each. Vetches (seed) and beans contain nitrogenous compounds in largest quantities, but when horses are fed upon either of these kinds of provender alone, the health soon fails, owing to the beans being too heating and binding; tares are too bitter as well as binding; but were the heating and binding beans and vetches mixed with cool and relaxing bran, which contains much less nitrogen, we should have the cheapest and most nutritious food which can be given to animals, and as wholesome food as it is cheap and nutritious. It is, however, absolutely necessary that the beans should be roughly ground; bruising only is not sufficient for easy digestion, nor do horses, as a rule, eat them so well. But horses must have some more bulky food than beans and bran; for however nutritious the diet, there must be bulk also. If hay is not used, some other kind of provender equally bulky must be substituted. In the horse the large intestines, as well as the stomach, suffer from long abstinence of food, and no class of horses are more subject to long fasting than farmers' horses. The smallness of the stomach shows that the horse should never go more than a few hours without food, yet we frequently see farmers' horses work from six to eight hours without food. The stomach becomes nearly empty, the intestines more or less filled with gas; the animal, notwithstanding this, is frequently allowed to take water and food *ad libitum*, as soon as they reach the stable, which they do voraciously, the result being an attack of gripes or staggers. During the spring months, when horses are at full or extra work, they generally receive three bushels of oats per week, with hay, but during the winter the amount of oats is somewhat reduced, on account of receiving cooked food once a day when on straw. The oats, for the most part, are given whole. For some time I have witnessed the crushing of oats with success, particularly in the feeding of old horses. The system of manger feeding has become very general amongst colliery, contractors', and carters' horses, and the expense of feeding is thus diminished very considerably. I think were farmers aware of the saving thus effected, this system would become almost universal. The chaff for manger feeding may be composed of two trusses of clover or meadow hay to one of wheat or oat straw, cut into pieces of a quarter or half an inch in length, mingled well together, the allowance of crushed oats and roughly ground beans afterwards added, and mixed with the chaff. For the agricultural and cart horse, 8 lbs. of oats and 2 lbs. of beans should be added to every 20 lbs. of chaff, and 36 lbs. of this mixture will be sufficient for any moderate-sized horse, with general or even hard work. Dray or waggon horses may require 40 lbs., yet it is difficult to lay down any given quantity, as the appetite of the horse varies so much; it will be best regulated by his attendant. The times of feeding should be as equally divided as

convenience will permit, and when it is likely the horse will be kept much longer than usual from home, the nosebag should invariably be taken, as his small stomach is emptied in a few hours. When the chaff is thus mixed with the oats and beans, the horse is compelled to chew his food; he cannot bolt the hay and straw, and while he is forced to grind that down, the oats and beans are properly ground with it, yielding more nourishment. The advantage derived from using a certain portion of straw cut up with the hay is very great, especially in farm establishments.

Good hay, perhaps, stands first in importance on the list of horse food. Great care ought to be used during hay harvest to get hay as full of the herb and flower as possible; inferior hay produces colic and irritable coughs, both of which I have seen gradually disappear by withholding the moulded hay on which the horses were feeding. The same remarks apply strictly to oats of inferior quality, with this exception, that bad oats appear to become a powerful diuretic, acting upon the kidneys, producing an immense increase in their secretions, the effects of which are rapid loss of condition, with great debility. It may not be out of place to notice the practice of wheat feeding, particularly when inferior wheat has been so plentiful. In an uncooked state wheat is not good food for the horse, unless given in very small quantities, mixed with oats; it contains a greater quantity of gluten than any other kind of grain. It is somewhat difficult to digest, and apt to cake and form obstructions in the intestines, not unfrequently raising fever. Similar results often follow from over-feeding with barley-meal, when putting horses into condition for market, particularly with free feeders. It is more nutritious than oats; but there seems to be something necessary besides a great proportion of nutritive matter in order to render any substance wholesome, strengthening, or fattening. Horses thus fed are more liable to inflammatory attacks, which are particularly seen in entire horses.

In the present system of feeding, some farmers appear almost compelled to give their horses straw during winter, generally when the animals are off work; but as straw requires more exercise to produce digestion, it ought to be given (if at all alone) when the animal is at work, as horses with voracious appetites and little work have time to eat a great deal more than the digestive organs can accommodate. It is an indisputable fact that there are more cases of colic during Sunday night and Monday morning than during any other part of the week. If the plan of giving horses cooked food was more adopted when feeding upon straw, much of this disorganization might be prevented. In Edinburgh, where cooked food is much approved of, the food used is well washed, generally being swede turnips and potatoes in equal proportion, then boiled and thrown into a large trough or cooler, and a little

wheat chaff along with a handful of salt for each horse, well mixed together. The weight of the turnips and potatoes, which is 56 lbs. when put into the boiler, is reduced to about 40 lbs., one-half of which is given at dusk, or whenever the horse returns from work, and the remainder at eight o'clock, when the men clean and do them up for the night, with oat or wheat straw, upon which the owners place no value, considering it as equivalent to the manure from the horses.

The giving water is a part of stable management from which the horse not unfrequently suffers. Horses, in receiving water, should not be always restricted, yet they should not be allowed to drink as much as they like on returning home over-wrought, hot, and tired. A single quart or two before entering the stable will refresh and invigorate, and be productive of no harm. After being a little cooled, water should be liberally supplied to him. Grass or green herbage is given to most horses during the summer months; and before turning horses out to the field it is necessary to prepare them for the change, the too sudden transition from dry to green food, and *vice versâ*, having the effect of causing obstructions in the intestines. Grass should be given sparingly at first, so that the stomach and intestines may be prepared gradually for the reception of succulent herbage. Horses, when taken up from grass in the autumn, ought to be put into as cool a stable as possible, with a full allowance of water, their food consisting of oats, mingled with bran, with two bran mashes daily for the first week, and a little hay. On the following week, more hay and oats may be given, and a bran mash withheld. It is necessary, in keeping horses healthy, to have stables well ventilated, clean, and thoroughly drained. We can scarcely have too much air entering in at any period of the year, providing it does not blow directly upon the horses. The temperature of the stables should range from 40 deg. to 50 deg. in winter, and from 60 deg. to 70 deg. in summer. Every stable should be thoroughly drained, not into a neighbouring cess-pool, but to such a distance as will preclude any effluvium escaping into the building. All dung and litter ought to be conveyed from the place twice a day.

To these useful remarks by Mr. Womack, we add the following paragraph by the Veterinary Editor of the *North British Agriculturist* :—

Foals dropped as they should be before the middle of May may be weaned about Michaelmas, when the mare will be required for the labours of the farm. When, however, the mare's milk is deficient in quantity or indifferent in quality, it is often advisable to wean the colt much earlier. If this has to be done before the young animal is many weeks old, it must be supplied several times daily with cow's milk, to which a little sugar is added. Besides

picking a little grass or clover, the young animal must further be early taught to eat a few bruised oats, some steamed bran, or other such food. At Michaelmas, the foal if healthy and well grazed will be strong and in good condition, and the progress thus made must not be lost. In many parts of England, and especially where old pastures abound, young horses, often promising and well-bred, are stunted in growth, and spoilt by being kept in the fields late in autumn, and even during winter exposed to the inclemency of all weathers, and receiving nothing but the coarse innutritive grass they gather. This is wretched parsimony. There can be no greater mistake than to stint young animals, or allow them to lose during winter the condition acquired in summer. So soon as the October nights get long and cold, foals should be brought into the yards or sheds, or placed in a field with a good open hovel into which they may run at pleasure. They must further be supplied, at least once a day, with some hay and a few bruised oats mixed with chaff or bran. If the weather continue tolerably fine, they will thrive better if thus allowed to be in the fields during the day, and protected at night. When frost and snow set in, the foals may be placed in their winter quarters. A good yard, sufficiently roomy for exercise, and provided with an open shed, is preferable to a loose box. Colts and cattle seldom agree well in the same yard. The colts, full of play, chase and disturb their more placid neighbours, which occasionally retaliate by a dangerous thrust of the horn. Barley and oat straw, frequently varied with an occasional allowance of bean or pea straw, may constitute the bulk of their winter food. A few handfuls of hay once a day are well bestowed, and are absolutely essential for weakly or late foals. A few sliced swedes, mangolds, or carrots, regularly given with some chaff, cut straw, or hay, keep the bowels open, and add to the general health. But besides this, and especially if the colts live more on straw than hay, they require some food of more nutritive character to keep them growing. For this end, supply to each foal daily three or four pounds of oats, which are best given cracked or bruised, along with several handfuls of chaff, and divided into a morning and evening feed. An occasional bran mash is also advisable; a pound of bruised oilcake daily, given with the oats, tends to keep the skin in a healthy state, and is especially useful when roots are not to be had; a piece of rock salt in the rack or manger contributes to digestion and health, whilst a sufficient supply of good water is fully as essential as good food. In early spring, and before there is sufficient grass to afford a full bite, colts may be advantageously turned out during the day, and brought in at night. Their management during the summer requires less notice. If they are to come to good size they must still be liberally dealt with, placed on good grass, their pasture varied occasionally, and ensured at all times a

good supply of water. In the succeeding winter their age and strength enable them to stand more hardships, and their fare need not be so nutritive as during their first winter. Good fresh straw, of varied sorts, a liberal supply of sliced roots with corn, bran, and chaff as before, will generally suffice without hay to keep them growing in sound health and improving condition.

Cattle are gradually taken up as they fatten on their pastures, where they may have latterly been receiving oilcake in addition to their grass. Some meadows will retain their growth and feeding powers later in the season than others; but during September the cattle must be thinned upon them, and if ripe for the butcher sold, or if unfinished, brought into yards, stalls, and houses, and fed on the earliest turnips, cut clover, hay, and oilcake. To this subject further reference will be made another month.

The Dairy.—We continue to quote the diary written by a Gloucestershire dairywoman in the *Agricultural Gazette* :—

The work of the dairy generally diminishes greatly in September; the milk is much less in quantity, but being of richer quality the curd is greater in proportion to the quantity of the milk than during the spring and the early part of the summer, and the cheese is fatter, consequently the best toasting cheese is made at the latter end of the season, but of course it must be done before the food of the cows is changed from grass. Cheese made this month and in October is liable to suffer from the early frost and dampness of the air, which affect the appearance, and cause it to become indented and rough in the coat, to prevent which great attention should be paid to frequent turning on dry shelves. These should be often washed, and when thoroughly dry the cheeses should be replaced upon them. They should never at this season be turned over upon the same space they have previously occupied, and there is generally now shelf room enough to allow of this, which will be an advantage to the late made cheese. It is necessary to scald the curd, to prevent its running out of shape; this will give it greater firmness than when made without it. The process is as follows:—When the curd is taken from the press the first time, the whey being thereby drained from it, it should be broken with the hands into small particles in the cheese-tub, when a scald of hot water, which should be mixed with whey, and made from 90° upwards according to the weather, should be poured over the curd, and after being well stirred round and gathered to one side of the tub, the scald should be taken from it, and the vats filled in the same way as when not scalded. It is well to make thicker cheeses in autumn, about five to the cwt.

These remarks refer exclusively to Gloucestershire dairy management. The Cheddar cheese-making has been already described (page 242), and the practice there given need not be altered.

Butter should now be potted for the winter as soon as convenient; it should be done before the falling of the leaves, which give a bitter taste if the cows are pastured where they have an opportunity of eating many leaves. The butter should be put in pans, in thin layers about two inches thick, and salt between each; this will cause it to separate when cut out, and will not require more salt to be applied to the mass than is usual to fresh butter; and it will cut out for use much more conveniently than when the salt is applied to the quantity, and not the rows separated by a layer of salt between them. It is well to make a little brine to put on the top of the pan, which will exclude air, and the pan should have a cover to it.

Cow food.—Dairy cows should get frequent changes and the best grass the farm will supply; for now that the growth is not nearly so rapid as it has been, it is astonishing how soon the keep gets short; and this may be a good deal accounted for by the old saying on the first coming of frosty mornings: "Now every beast has *five* mouths;" that is to say, the tread of each foot makes useless as much grass as the one mouth consumes; therefore it will be found a great saving of green food, which it is desirable to make last as long as possible at this season, on ordinary dairy farms, that the cows should have a little hay given to them in the yards every morning before they are turned out from being milked, and they should remain an hour to eat it, by which time the frosty appearance on the grass is gone. This supply of hay will be found to be well-spent, inasmuch as the milk is more rich in quality at this season, when the weather also is more favourable for making good butter and cheese; so it is very desirable to keep up the quantity of milk by every means within reach.

Calves.—The weaning calves should this month have access to the grass fields only during the day, having shelter in yards at night, where they should get some chaff of oat or barley straw, and their troughs filled with early turnips cut small, to enable and induce them to take readily to eating them. This feeding will materially assist their growth, and strengthen them against the winter. Some farmers, who annually rear a large number of calves, recommend that they should get a little oilcake with the chaff, in preference to so much green food, as a safeguard against quarter ill or evil, which fatal complaint often carries off many of the most healthy and thriving weaning calves at this season. The quantity should be given from half a pound, and increase, according to their age and as they seem to thrive upon it, up to two lbs. every evening. This somewhat high feeding has proved serviceable in rearing calves for fattening purposes, to be ready for the butcher as fat beasts at two or three years old; and when the grass fails for their daily food, a liberal supply of roots is given them instead. But to rear

healthy constitutions for dairy stock, we recommend less forcing feeding, as that given above, without the oilcake ; which, though less fattening, is quite sufficient to produce fine healthy growth.

Quarter ill happens to young animals, such as yearling heifers, at this season, and is caused by lying on a cold, damp soil, and particularly when there is a hoar-frost. By housing the young animals at night, putting them in sheltered yards before the winter comes on, we shall do much towards the prevention of this disease ; and, in addition, liberal food will be of great assistance. The use of oilcake has been found to ward off this disease. So likewise care in spring, when they are again especially liable, by gradually changing the pasture, not to run from one extreme to another.

The "hoose," or "hask," another prevalent disorder at this time, is a disease of the windpipe, to which young cattle and calves are subject. A dry husky cough, increased perspiration, and great weakness and indisposition to move, are caused by small white worms in the windpipe and bronchial tubes, which keep up constant irritation. Administer half a pint of lime-water every morning, and a table-spoonful of salt to each calf every evening, for four or five days ; or 1 oz. of oil of turpentine in 4 ozs. of linseed oil, repeating the dose once a-week several times.

Sheep.—The ram is now put with the ewes—one to 60 or 70—even in the later districts of England, and both are put in good pastures, and kept in condition by ample feeding.

This is the season when it is proper for those who do not breed their own stock to be purchasing for winter feeding. Early turnips may be commenced with sheep. Such a stock should be purchased as shall consume all the white turnips by the middle of November, the yellow sorts by the end of the year, the swedes by the end of March, and the mangold wurzel by May. And to assist calculation, it may be assumed that good crops of the above roots on ordinary soils will yield per acre 24, 20, 16, and 26 or 30 tons of clean roots respectively ; and that a fatting animal, either sheep or ox, supposing it full grown, will in general, when out of doors, eat a weight of these roots equal to about a quarter of the carcase weight it is expected to attain when ready for the butcher. If fed under shelter, three-fourths of this quantity may be assumed as the basis of calculation. If this be true, and from a somewhat extended experience on this subject we believe it to be so, what a saving does this shed-feeding hold out to the winter grazier ! It is objected to the system that it entails the heavy expense of carting the crop to the buildings, and the dung back again ; and, in the case of sheep, that it renders them especially liable to the foot-rot : but the first item may be greatly diminished by erecting a temporary shed on the neighbouring stubble field, which will require all the manure made there for the ensuing green crop, and thus the second

item will disappear. Such a shed may be easily erected with poles and hurdles. A few larch poles, nails, hurdles, and bundles of straw are the materials required; they are not costly, and certainly they will not exceed in expense 6*d.* for each of the sheep they shelter. And as regards the foot-rot, it need not be troublesome if you pare the overlapping horn from the hoof once at least every month, and apply a slight caustic ointment on the first symptoms of lameness.

The following is a recipe by Mr. W. C. Spooner, V.S., of Southampton. The cure consists in removing sufficient horn to allow any confined matter to escape and to apply a styptic or caustic to the part, so as to prevent proud flesh growing, and to stimulate the vascular parts to secrete healthy horn. A number of medicines have been recommended and with success; muriate of antimony applied with a feather is a very convenient caustic, and so are likewise equal parts of hydrochloric acid and tincture of myrrh; a strong solution of sulphate of copper is a milder dressing, and tincture of aloes or friar's balsam is milder still. All these are useful if applied with discretion, according to the severity of the case. Another useful application, as well as a preventive, is coal tar, particularly if a little creosote is left in or added to it; and some powdered plaster of Paris over the tar will assist its drying effect. A change to a dry pasture or soil is necessary. Sulphate of lime powdered, 1 oz.; sulphate of zinc powdered, 1 oz.; creosote, 1 scruple; Stockholm tar, 4 ozs.; lard, 4 ozs.; to be made into an ointment, and applied occasionally to the feet of the sheep and between the claws, first paring the overlapping horn away, and clearing everything away without drawing blood, is a good recipe.

Lambs are at this season sometimes troubled as calves are with the hoose, a disease whose character is sufficiently attested by the post-mortem examination of its victims revealing the presence of an immense number of small worms in the windpipe and bronchial tubes of the lungs, so that we cannot wonder at the gradual pining away which denotes, or the fatal result which so often follows this affection, if allowed to go on unchecked. Not only is the body deprived of its nourishment by these innumerable parasites, but the proper changes of the blood are retarded or prevented from being accomplished in the lungs.

The following are remarks by Mr. Spooner on this disease:—
 “Any medicine given to destroy worms in the air-passages acts by being absorbed into the system. In the case of worms in the windpipe two objects should be sought for—one to destroy the enemy, and the other to strengthen and support the system which is being subjected to such debilitating and exhausting influences. In the case of the ‘gapes’ in chickens, a similar affection, some speak of the good effects of tobacco smoke introduced so as to almost pro-

duce suffocation, albeit the creatures sometimes die of the remedy. In calves a cure has been effected by administering lime water, and probably it would be equally effectual for lambs. The dose for a lamb would be about two ounces daily, and about two drachms of salt should be given at another portion of the day. This treatment should be followed for some days. Better still is the plan of administering oil of turpentine, which being taken into the stomach is soon absorbed throughout the system. The dose for a lamb is two drachms, which should be given with an ounce of linseed oil, a scruple of ginger, and five drops of oil of caraways, mixed up with two or three table-spoonfuls of linseed gruel. This dose may be repeated if required several times, with intervals of some days. The lambs should be allowed half a pound of linseed cake per diem, and should be otherwise carefully tended and liberally fed. By such a course of treatment, many valuable animals may be saved."

Tegs put to fatten in the fold on turnips or rape should have clover hay given in racks along with the usual fold of green food. And those which are forward in their fattening, and are to be sold at Christmas time, may receive the best food which it is the practice to give—as 1 lb. of oilcake or 1 pint of pease daily a-piece.

When it is the custom to buy ewes for the sake of a crop of lambs, they should be purchased early in September. Young ewes are to be preferred, and it is well to choose a ram of a larger breed than themselves, as a Cotswold ram to a lot of Down ewes. This is in the case now not uncommonly adopted, of lambing down a lot of ewes and fattening both lambs and ewes off as rapidly as possible in the following summer.

We add here the monthly notice of proceedings on the Lammermoor sheep farm:—

"We commenced cutting corn on the 30th August, and finished on the 11th September, and expect, if the weather continues favourable, to carry all this week. This is a very early harvest. We have still some hay to stack, the weather having been so windy, that it has frequently been impossible to meddle with it. It is all, however, in large ricks in excellent condition. The carting of the hay is a tedious business, most of it having to be taken several miles away over very bad roads. It is put up in stacks of 300 or 400 stones each, beside the best sheltered stells; this quantity ought to keep 200 sheep for a month, provided they are able to scrape something from under the snow. The lambs are now all away from the ewes, and nearly all sold, except the ewe lambs required to keep up the stock. During the past summer we have been very careful in having the sheep-pens well strewed with quick-lime, whenever we had occasion to have sheep in them; the consequence is, that we have scarcely any footrot. The draft ewes will be marketed forthwith."

Swine will be brought in from the stubbles as soon as the work of picking up the wasted corn is completed. They are, indeed, brought in daily during the fortnight while they are thus herded in the stubbles, and receive cut vetches or clover in yards. Now they receive in yards the refuse of all kinds of green crops, as mangold wurzels that have run to seed, the bad and small potatoes which are now being dug, cut clover, turnips, &c.; and with this the waste of the dairy, brewers' grains, a little meal and hot water with it, &c.

Of course fattening swine get better food—barley and oatmeal forming the staple of it.

Sows put to the boar towards the end of this month will bring forth towards the end of January; and it may be better therefore not to allow them access to the boar till the end of October, or beginning of November, so that they shall not farrow until after the days have begun to lengthen and become warm again.

VII.—FARM ACCOUNTS.

It is not the intention of this work to give a treatise on this subject, which is, indeed, matter enough for a book to itself. It must suffice here to say that the principles on which farm accounts are to be kept are precisely those of commercial book-keeping. The basis of the whole is in the day-book, which records every transaction, whether of sale or purchase; and from this every item is transferred to a ledger, and placed, first, on the Dr. or Cr. side of the cash account, which includes all payments and receipts of whatever kind, relating to the farm; and, secondly, on the Cr. or Dr. side of that particular account or class of items in which it is properly included.

All the money transactions of the farm may thus be classed, and for each class a particular account is opened in the ledger. All payments or receipts connected with (1) the horses, (2) the fattening or the store cattle, (3) the flock, (4) the stock of swine, (5) the wheat crop and the other grain crops, (6) the green crops, (7) the implements, (8) the landlord, &c., may thus have special accounts opened for them. At the end of the year you may, by adding up the payments made under each head, and the receipts under each head, find out the expenses of each and the returns from each. And if, in addition to mere money payments, you also add the valuation of stock under each head, and place that first on the list at the commencement of the year, as having been then entered to by purchase as it were; and if, in addition to money receipts during the year, you also add the valuation of stock made under each head at the end of the year, and place that last on the list among the receipts as being in hand, and ultimately to be sold, then the balance-sheet in which the costs and profits respectively, under all these several headings,

are pitted against each other, will represent the profit or the loss of the whole proceedings of the year. This, of course, supposes that all debts to or by the farmer be valued as so much stock, and placed so as to increase or diminish the balance of the accounts which they affect.

Of course it is the cash and stock accounts which will determine whether or not the farmer's year has been profitable: but as it is the object of exact accounts to ascertain where the profit or loss has occurred, so as to enable the correction of practice by the profit or loss of any part of that practice, there is a need, beside the mere cash account, of this variety of other headings, under one or other of which in the ledger every transaction may be entered.

In the original edition of this work a good deal of, as we think, unnecessary trouble is recommended to be taken, in order to the particular division of the farmer's expenses over every particular field, or account that he may open. For instance, Arthur Young spoke thus of

Rent, Tithes, Taxes, and Assessments.—These articles demand four accounts, to be kept separate; but they are all to be arranged on the same principle. The amount of the three last, when known at the end of the year, must, like the rent, be divided over every field from which an account is kept: this is very easy, when the measure of the fields is known. The rent must be divided as exactly and as fairly as possible, and the three other articles should be proportioned to the rent.

The main difficulty is the difference between the gross and the neat measure of the fields of a farm. The hedges, ditches, and borders take up, in many farms, a considerable portion of the field; from one-eighth to one-twelfth, and in some even more;* now if these be reckoned and accounted for as a part of the field, then the acreable produce is affected, and even the profit of the husbandry, by a circumstance not essentially connected with it; and if two fields be compared in their husbandry, that may be most advantageous which has least border, and for that reason, which would derange a comparison entirely. The remedy, of course, is to measure the contents where the plough goes in an arable field, and where the scythe cuts in a grass one; and then deducting the total of those measures from the gross contents of the farm, throw the difference into one account by itself, under the title of *fences and borders*, to which must be charged the proportion of rent, tithe, and parish taxes. If wood be cut or grubbed from these borders, or grass mown from them, the value of the wood or hay is to be credited. The expense of the fences to be charged, and the balance of the whole—for it may everywhere be expected to prove a losing

* Margins of grass are common round the fields in Suffolk.

account—is to be considered as the expense of fences, and acreably divided over the whole farm, like rent, tithe, or parish taxes.

We give this passage illustrative of the extreme detail recommended by Mr. Young, which, however, is not likely to be adopted by the practical farmer. The accounts already named are sufficient in ordinary practice. The labour book, by which the amount of wages paid weekly is easily divided weekly or fortnightly among the accounts for the benefit of which the labour has been applied, is described at page 177. In some cases it may be possible to do with a much smaller number of accounts than that already given. In fact, the whole costs may be put down to 3 or 4, such as grain crops, green crops, live stock, and landlord; and in such a case it may be possible to keep the whole series of accounts in a single book.

The following, for instance, is such a plan. It is simply a method of classifying cash payments and receipts; it does not pretend to arrange or record either debts or credits—these are most easily kept account of by invoice cheque books; one, a leaf from which should accompany everything sold off the farm, whether for cash or not, and another in which receipts of unpaid goods must be acknowledged as from the parties sending them. Every money transaction is to be entered and described in the farmer's pocket memorandum book, and thence to be transferred to the pages of a book ruled as below.

Farm accounts for the Week ending—

Names.	M.	T.	W.	Th.	F.	S.	a	b	Labour	Total.
PAYMENTS.							£ s. d.	£ s. d.	£ s. d.	£ s. d.
J. Smith	ab	b	a	u	b	a	0 7 0	0 5 0	0 12 0	0 12 0
J. Cook, 1 ton of Oilcake ...				—				8 10 0	.....	8 10 0
Carried over...	...	...	...	...	...	...	0 7 0	8 15 0	0 12 0	9 2 0
RECEIPTS.										
J. Brown for 10 qrs. Wheat		—					25 0 0	.....	.....	25 0 0
W. Smith for 10 fat bullocks			—				.....	214 0 0	.....	214 0 0
Carried over...	...	...	...	...	...	...	25 0 0	214 0 0	.....	239 0 0

The six small columns are for entering, each day, the labour done by each man against the account for whose benefit he has been working. Columns *a* and *b* are for the record of money transactions about the different accounts it is desired to open: thus, *a* may be the grain crop account; *b*, the green crop account, including all

animals bought to consume them or sold after consuming them; and as many other columns, *c, d, e, &c.*, may be provided as may be required for any other accounts that it may be desired to open. John Smith, it will be seen, was at work on Monday for the benefit of the wheat crop half a day, and for the benefit of the green crop account, half a day; on Tuesday for the benefit of the green crops, and so on. And on the lower half of the page, devoted to the record of receipts, it is seen that on Tuesday of that week, ten quarters of wheat were paid for by J. Brown. The last column represents the cash account in a ledger—the balance of its total receipts and payments gives the gross result of the money transactions; and a similar balance, in the case of each of the other columns, explains the manner in which that gross result has been arrived at. Thus, in one page, at the close of the year when the farmer's liabilities and property are valued, and entered as paid and received for, he will see the exact financial result of his conduct during it, and be prepared during the ensuing year to modify his plans according as they have proved profitable or otherwise in the different departments of his business.

The time of balancing the books every year should be that of entering the farm. This is most usual at Michaelmas; but the crop of the year is not then disposed of. To avoid valuations, which ought never to be relied on when certainty can possibly be gained, the old year's accounts may be kept open long after the new year ones are begun; that is, till the corn is all threshed and sold, till the fattening beasts are gone, and till all those circumstances are decided which relate to the preceding year. This is essential to exact accounts, and can by no means be dispensed with. In this case, valuations may be nearly rejected, but there are others in which no management can exclude them: these are, in *live stock* not bought and sold within the year, and *implements*.

A man may stock his farm with cows at 15*l.* each; but if he suppose them, some years after, to be worth the same sum, he will grossly deceive himself. He must value them every year, and also the young stock which he rears, with a view to keep up the number, or for sale; and the rule by which he should make the valuation, ought to be the price they would sell for at the moment. The same management must direct valuations of succession beasts, bought or bred for fattening, and also of a flock of sheep.

Implements, again, must all be valued every year, and the balance, being the expense, will have its effect in the balance-sheet of the year, going of course to diminish the profits of the year.

We add a remark here on one class of expenses which the tenant farmer incurs, which should be kept separate from all the others—viz., those connected with the permanent improvement of the land, and placing it in that state of cultivation which it is intended to

maintain. Many tenants, secured by a lease, are engaged in this which is properly landlords' work; and for them, in the first and second years of their occupation, to charge against the returns of those years the whole cost which has been then incurred would be obviously unreasonable. Wherever the same capital is invested, and the same skill and judgment exercised, the accounts may under ordinary circumstances of weather, &c., be expected to show a similar annual income; and so, no doubt, if properly kept, they will, *plus* or *minus* the *extra-ordinary* effect of weather and prices. But to do as is often done—to charge upon each year all that, during it, has been invested in the permanent improvement of the land, would have the contrary effect of exhibiting a *loss* upon every fresh investment of capital, and consequent additional exercise of skill. All such expenses should be placed in a "dormant capital" account, and while on the *whole* sum which appears there at the end of each year (along with all the rest of the farm capital) the usual per centage should be charged in the annual balance-sheet, such a portion only of the *principal* should also annually be charged before the "balance" is struck, as shall exhaust the "account" by the end of the lease. If 100*l.* be spent in draining during the tenth year before this period, then year after year on the Dr. side of the dormant capital account the sum standing will be 90*l.*, 80*l.*, 70*l.*, &c.; 10*l.* per annum being annually abstracted and charged on the gross produce of the farm before the clear profit of the year can be ascertained, and in addition to this, five per cent. has also every year to be charged on the 90*l.*, 80*l.*, 70*l.*, respectively, which at those periods represent the amount of the farmer's capital still remaining invested in that particular form.

The yearly inquiry into the profit or loss attendant upon the twelvemonth's proceedings is really a very simple affair. Suppose a farmer to have commenced his year's accounts aright, he then entered (whether actually or not), by *purchase*, into his position; and the several portions into which his capital at that time invested might then have been divided were placed on the debtor side of the several accounts which concerned them. The sheep account received its record of the value of sheep on hand, and of that portion of food to be consumed by them then remaining; the grain crop account received its record of grain in rick and barn, of seed sown, of ploughings, harrowings, &c., by which the crop had till then been benefited; and so on. Since then, payments on account, whether for labour, or stock, or food; and receipts on account, for produce of all kinds, have been regularly entered; and all that has now to be done is to estimate the present position of the farmer just *as if he were about to give up business altogether*, and to place as per valuation his *present* invested capital on the creditor side of the several accounts to which it belongs. It then merely remains to arrange

the balances of these accounts—debtor or creditor, as the case may be—in columns on a sheet ; to charge 5*l.* per cent upon the working capital of the concern, together with that share of the dormant capital which *this* year must return ; and the balance when struck will represent the income of the year.

VIII.—THE LEASE.

While this work is going through the press (October, 1861) the landlords of England are addressing the tenantry of the country at the annual meetings of Farmers' Clubs and Agricultural Societies ; and it is satisfactory to find that the leading men among the former class agree with the energetic and intelligent of the latter in the soundness of their views upon the relations between the two to which expression has been given at pages 63—73. Take the speeches at the meetings of the Buckingham and the Worcester Agricultural Societies for example.

At the latter Sir J. Pakington, M.P., gave it for his opinion that when agricultural skill had been acquired, agricultural science exercised, and capital in proportion to that science brought to bear on the cultivation of the soil, the tenant was entitled to some better security than a mere yearly holding. He said that he had recently let a large and excellent farm to a new tenant, who had commenced his work in a way that showed him to be a man of skill, enterprise, and capital. His offer to him of a lease was, however, refused. The tenant was aware of his character as a landlord, and was willing to remain a yearly tenant. Sir J. Pakington said that he believed this tenant made a great mistake. It must be remembered that life was uncertain, that circumstances might change ; and the tenant ought to think of his own interests and the interests of his family, and to take some security for his investment. The history of another tenant who had long lived with great credit on Sir J. Pakington's estate, and who a few years ago had expressed a great dislike to the leasing system, was also given. This gentleman had shared in that panic which followed the repeal of the corn laws ; but latterly he had expressed a wish to have a lease of the farm for twenty-one years. And Sir J. Pakington drew these inferences from the two cases : (1) that farming to be successful must be conducted on the same principle as other commercial pursuits ; (2) that to do well in farming capital must be invested in the land, and (3) that when once it was thrown into the land the tenant ought to have some security that he should get it out again. He believed the solution of the great agricultural problem was to be found in three conditions : First, that no man should undertake a farm until he had made himself acquainted with his business ; secondly, that

no man should undertake a farm that was too large for the capital which he had to expend upon it ; and, thirdly, that when he threw his skill and capital into the cultivation of the land, he should take care to stay there as long as his interests required.

The Earl of Dudley also spoke on the subject of farm leases at the same meeting, and asked whether the refusal of leases had come from the owners of land, or whether it arose from the indisposition of the tenants to accept them. The answer given by the meeting was—"From the owners of land, my lord." The following conversation between his lordship and his audience which then ensued is exceedingly satisfactory and instructive.—He held not that the landlord refused to grant leases, but that the English tenant was disinclined to accept them. ("No, no.") Did they mean to say that, as a rule, the owners of land had refused to grant leases? (A voice : "As a rule, certainly, my lord.") If that was the case, then his argument went for little ; but he was bound to express his belief that if there were some landlords who refused leases there were more willing to grant them. He would speak for himself, that if he could get a tenant who could and would do his duty to the land, he would only be too happy to grant a lease to him, which even his death should not make void.

At the Buckinghamshire Agricultural Society's meeting again, Sir Harry Verney, Bart., thus spoke :—

It was to be remembered that for the promotion of agriculture capital was necessary. He hoped to see the day when they should have the capitalists of the country going hand in hand with the agriculturists in making the land produce as much as possible. He knew that there were many landlords between whom and their tenants an entire confidence prevailed ; but the system which he wished to see prevalent—that of capitalists putting money into land to make it productive—required something more. Of course the capitalist could not be expected to invest his money in the cultivation of land unless those who cultivated it were men of intelligence and principle, and in addition to this possessed of a certain permanency of tenure in the land. How such a permanency was to be given except by lease he could not discover. Therefore he should be happy to see a system of long leases come into greater prevalence than they had yet seen in this country. If the landlord gave a lease, he would expect an assurance that the terms of the written agreement would be observed ; and he consequently must have his conditions as well as the tenant ; but what he desired to see was, the tenant farmers of this country with leases which would enable any of them to go to a capitalist and say, "I have got this farm for twenty-one years, will you trust to my intelligence, honesty, and skill as an agriculturist and lend me money to cultivate my land?" He believed that such a thing as that was practicable,

that it would be for the advantage of the community at large ; and for that reason he should be glad to see it in operation.

The general principle acknowledged and advocated in these addresses is unquestionably correct. The only room for criticism on that of Sir H. Verney seems to us to be, that he does not appear to observe, or at any rate to give that prominence to the case of the man who is both capitalist and farmer in one. It is *he*, we imagine, and not the farmer assisted by the capitalist, to whom we must look for the improved agriculture of this country. And the need of the lease, plain enough to Sir Harry Verney and his audience, when the mere cultivator, possessed of intelligence and skill, seeks the assistance of the mere capitalist to enable the right application of his intelligence and skill to the cultivation of the soil, is equally obvious and necessary when the cultivator, who is also a capitalist—the capitalist who is also a cultivator—is seeking for a field on which he may profitably invest his means. The lease is, we are persuaded, the only kind of tenure under which the high cultivation of land can be either induced or maintained, whatever the nature of the compact between the cultivator and the capitalist may be, and notwithstanding that there are landlords who will not grant leases for lengthened periods, and that there are tenants who will not accept them, it certainly must be for the national good that this mode of tenancy should more generally obtain. Farmers may fear being tied for more than one year to a bad bargain ; this only exhibits a want of energy, and of enterprise, and of confidence in their own judgment. Landlords may fear abandoning their estates for so long to incompetent tenants ; they forget that when a farmer is tied to the land for so many years, his interest in maintaining its fertility is equal to, if not stronger than that of its owner. And it is capable of demonstration, both on *à priori* grounds and by an appeal to fact, that the increased profit of both parties, dependent as it is upon the exercise of capital and intelligence in the cultivation of the land, can be looked for only in those districts where the fruits of high farming are secured to the farmer by a sufficiently long lease.

How, then, must it be where neither intelligence nor capital are abundant amongst farmers ? Why, then we fear they cannot look for more than yearly tenancy. This, fortunately, is to *them* no hardship ; for where there is not capital to carry out, nor intelligence to direct the higher cultivation of the land, there is rarely enterprise desirous of any change from things as they are. Nevertheless here, also, it will be for the landlord's interest to state openly and publicly his desire, whenever these shall appear in his tenants, to give them the security of a lease.

But the advantages of the lease, and of the lease supplemented by the observance of a tenant-right which shall reimburse the cul-

tivator for energetic cultivation up to its very close, have been already discussed, and the folly of extreme detail in the conditions of cultivation, and of excessive penalties on departures from the specified routine, has been already pointed out, (p. 63, &c.)

Let us, however, repeat it. Tenancy, depending for its period upon the will of the landowner, however it may be cloaked over by arrangements for the security of "tenants' rights," can never be so acceptable to an intelligent man of capital—and *he* is the tenant to be desired—as when it is simply secured to him for a period of years by a legal instrument. The farmer wants a *home*, as well as mere security for his money.

Nevertheless, as already urged (pages 67—71), a system for securing the "tenant's rights" is a useful, and, indeed, a necessary *adjunct* to the lease. The object of the lease should be to secure the property of the landowner, as well as that of the tenant; and this, as it is drawing to a close, it is unable to do. No written stipulations will prove a security against a tenant who is disposed or determined to impoverish the land, and therefore it is desirable to adopt some arrangement which shall make it the tenant's interest to farm highly *throughout* the period of his lease. As the matter at present stands, land is often entered upon "out of condition;" a period of five years elapses during which the tenant is repairing it; for the next ten he reaps the fruits of good farming, and then, from a regard to his own interests, he proceeds to diminish his expenses, and ultimately he leaves the farm as he found it. During one-half only of the lease is the land farmed as it ought to be, and the result to all parties concerned is as if only one-half of the district were properly cultivated. How much better it would be if the tenant, entering upon the farm in good condition, should find it to be his interest to cultivate it highly *throughout* his tenancy! And it can be made his interest to do so, either by an arrangement with him, entered upon before the expiry of his lease, for a re-occupancy of the farm, or, which is the least likely to fail, by offering such a security for the "tenant's rights" as shall make it as much his interest highly to manure, and thoroughly to cultivate, his last year's green crops, as it was his interest to farm well those of any preceding year. This will be effected by an arrangement for paying him such a portion of the expense of those crops as may reasonably be supposed to remain unexhausted for the benefit of the incoming tenant's first grain crop, and by paying him the full value of all straw and manure he may leave behind him.

It is for the interest of the nation, as well as of every class in it, that the land be farmed by intelligent men of capital. Landowners will be benefited by having such tenants upon almost any terms, excepting, of course, such as would involve a sacrifice of the annual

value of their property; but they may rest assured that such tenants will never offer themselves, except where they can have free scope for the exercise of their intelligence, and perfect security for their property.

Intelligent men of energy and sufficient means should therefore be simply tied to the land they have to cultivate for a long enough time—the longer the period of the lease the more does their interest in its fertility correspond to that of the owner—and some years before the close of the period they should be treated with for a renewal of the contract. The possibility of such a negotiation coming to nought should be met by the establishment of such rules, on the one hand, acknowledging tenant-right, so as to make it the interest of the tenant to cultivate vigorously to the end of the period, though he is then to leave the farm; and on the other hand, forbidding such cross-cropping and sale of farm produce as everybody admits to be against the practice of good husbandry.

Both views of the subject—that of a vigorous tenant, and that of an intelligent landowner—are well expressed in the speeches of Mr. Samuel Sidney, on the one hand, and of the late Robert Baker, of Writtle, on the other, at a discussion on the subject some years ago before the London Farmers' Club.

Mr. Sidney said: Many landlords still act in some degree under the influence of the feeling that they are conferring a favour on their tenants by allowing them to occupy their land. That notion is a great hindrance to good cultivation. Is not that form of agreement the best for him as well as for others which induces the tenant to put as much of his floating capital into the soil as he can employ at a profit? He must have a rotation of crops, use the best descriptions of farm implements, lay out very large sums in concentrated manures, and maintain a numerous stock upon the land. Is there one who will go and put his 8% or 10% an acre into the soil for these purposes upon an annual agreement which places it in the power of the landlord, or the landlord's trustee, agent, or even gamekeeper if there happens to be a quarrel with that individual, to give him notice to quit, turn him out at the end of eighteen months of his tenancy, and leave him to a lawsuit or an arbitration for compensation? In considering this question we must not keep our eye upon model landlords, but bear in mind that we are asked to sanction a form of agreement which may be adopted under any circumstances between two different men. With regard to the broad and general principles on which all farm agreements should be founded, in order to develop to the utmost the agricultural resources of the soil, the following circumstances are essential:—

1. That the landlord should provide the buildings, farm steadings, roads, drains, fences, required for the cultivation of the farm.

2. That the tenant should, in addition to experience, possess capital sufficient to provide the implements, machinery, stock, seeds, artificial manures, and labour required by the farm.

3. That the tenancy should be on terms that would enable the tenant to put the farm through at least one complete rotation of crops, with security for return of unexhausted capital sunk in the soil.

4. That as minute restrictions hamper a good tenant, and do not restrain a bad tenant, the restrictive clauses should be as few and simple as possible.

Mr. R. Baker, of Writtle, again, had always held the opinion that in making an agreement for letting lands, it is more advisable to secure the tenant in the money he invested by way of improvement as he went on, than to pay him an amount of compensation upon leaving. It is no remuneration merely to pay him for the improvements which are unexhausted. That is only the last act of justice which can be done him in taking the farm out of his hands, or letting it to another tenant at an increased rent. It must be obvious to every one who regards the matter in the light of a commercial transaction, that, in taking a farm and looking to it to repay him his investment of skill and capital, to bring it into a cultivable state, it is more necessary to have security for repaying himself the outlay in improvements, than defer it until the expiration of the tenancy, when it will have to be paid by another. The object should be rather to convince the landlords as to what their interests were, than to dictate the terms upon which they should let their farms; in all arrangements they should be governed by this principle, that, whatever the improvements on an estate, they should be suffered to remain there, and not be withdrawn by the tenant at the end of his term. It had been very much the custom in his neighbourhood, where the farms were let for fourteen years, for the tenant to go on farming exceedingly well for the first seven or eight years, but after that time he made it his business to exhaust the improvements, until, at the expiration of the term, the farm was left in as bad condition as, or worse than, when he first took it. Now, he wished to see that system obviated by restrictions being introduced into the clauses governing the latter portion of the lease, so that the tenant should not be allowed to exhaust his improvements, but should be paid compensation. He held that the best form of agreement would be that which would give the tenant sufficient interest in the soil to induce him to invest his capital therein; that would give him sufficient time to get a return from it; and that at the expiration of his term would pay compensation in proportion to the amount of capital he had invested, over and above what was invested under the ordinary modes of farming, and over and above what he might have

extracted and returned to his own pocket. He (Mr. Baker) should say that that would be best effected by a running lease extending from ten to fifteen, twenty, or twenty-five years, and terminable by either party giving to the other five years' notice in writing to that effect. But no tenure of land should be commenced without a written agreement. Everything should be reduced to writing, which would prevent a vast deal of trouble in the end; and as the stamps on leases were reduced, there would be no difficulty in effecting it on that account.

As to the written conditions of cultivation to which Mr. Baker refers, it is well to bear in mind what Mr. Caird long ago declared with truth, that "the landlord who continues to bind his tenant down to a prescribed routine, from which he must not under a penalty deviate, inflicts upon him a very serious injury, without any corresponding advantage." It may be well, for a while, to bind down ignorance to a routine prescribed by greater knowledge, but after the lapse of years the knowledge which has prescribed it itself proves ignorance in comparison with the intelligence which has since arisen; and the rule proper for the time when successive crops of oats, followed by natural grasses for a number of years, were the custom, cannot properly apply to the present time, when chemists have answered the question, What is fertility? and when commerce has furnished the means of its artificial maintenance.

We do not go into the conditions of the lease beyond this assertion of the general principles on which they should be laid down. The landlord will of course take care that no permanent grass land be broken up without his leave, and he will, as we have said, provide for the proper cultivation of the arable land towards the end of the term. This he will do both by offering the inducement of a liberal tenant-right, and by actual rule; insisting, for instance, on the observance of alternate green and grain crop cultivation during the last four years; or on the laying down a certain extent, say one-fourth, of the arable land to clover during each of the last two years. As to cultivation during the term of the lease, it had better be left to the intelligence of the tenant. It may, however, if it be against the custom of the country to allow the sale of hay and straw from the farm, be advisable to remove that restriction only on condition that the whole or a certain portion of the amount received from such sale be spent on cattle food or manures for use upon the farm.

On hiring Farms.—We may presume, then, that the landlord and tenant are agreed as to the relations which are to subsist between them, as to the period of their connexion, and as to the liberty of action to be allowed to the latter in the cultivation of the land. But we have not considered the circumstances which should guide

the tenant in seeking for a farm. This may be done in nearly the words of the original edition of this work :—

September and October are the usual time of year for hiring and stocking farms, and moving from one to another. The farmer should on such occasions be equally clear-sighted to the advantages of a farm and to its disadvantages, that he may be able to draw a balance between them, and compare that balance with the rent demanded. He must equally discard a too solicitous prudence, which doubts every benefit, and a too daring courage, which overlooks or lessens real evils. It must be open to almost every person's observation, that many lose themselves in deliberating concerning a farm : they have so many mistaken rules of judging, that we sometimes see them reject farms which soon after are hired by others, and prove their fortune : they are apt to take one false guide in particular—the success of the last tenant. If a man makes a good deal of money on a farm, or leaves it for a much larger, numbers will immediately apply with eagerness to get it ; but if a tenant or two break, or are poor on a farm, most of the neighbours consider little farther : they attribute too much of the ill success to the land, and avoid it, under an idea that, without a fall of rent, no money can be made on it.

One general rule in hiring a farm should not be forgotten—to fix on good land, and he can scarcely pay too much for it ; but, for poor soils, the least rent is sometimes too high to be consistent with profit. A mellow, rich, sandy loam is probably of all soils the most profitable : such as will admit tillage soon after rain, and does not bake on hot gleams of sun coming after heavy rains, when finely harrowed : such land is better worth forty shillings an acre than many soils deserve five.

Stiff loams, allied to brick earth, when drained, are among the richest and most profitable of soils to cultivate—capable of yielding all kinds of crops, especially the most valuable grain crops ; and at the same time being economical and careful of the manures that are applied to them. Gravelly soils are very different in their natures. Warm, deep, dry, sound, gravelly loams are easily distinguished by their fertility. Wet, cold, springy gravels are, on the other hand, and till drained, poor and unprofitable.

Sands are as various as gravels. The rich red sand is, I believe, as profitable a soil as any in the world. It is at all seasons sound, and at the same time moist enough to secure crops even in dry summers.

Strong, harsh, tenacious clay, though it will yield great crops of wheat, is yet managed at so heavy an expense, that it is usually let for more than it is worth. Much money is not often made on such land. The very contrary soil, a light, poor, dry sand, is very often

indeed in the occupation of men who have made fortunes, especially when some permanent manure and marl is found below the surface, which answers well to spread on the surface; and sheep, the common stock of such soils, are a profitable stock to keep. Stiff soils are, however, by draining, burning, and deep cultivation during dry autumn weather, which last can be effected by the steam plough, now rendered much more capable of profitable cultivation.

Alluvial soils, which go under various names, such as silt, warp, &c., are among the richest that are to be found.

In respect to grass lands, the marks for judgment are different. These are best examined by attending, first, to the circumstances in which they are most deficient; and then to such as are in their favour. The more seasons grass fields are viewed in the better; though any one is sufficient for a tolerable judgment.

One evil attending these lands is, that of being too wet, the signs of which can never be mistaken in any season of the year. The presence of the rush, sedge, and moss; also the colour of the grass, sometimes bluish green, from the presence of sedges, sometimes of a dirty yellow hue, and always coarse, are sufficient indication of quality.

Grass fields on gravelly soils are, if the gravel is sharp, very apt to burn in dry summers; but they give great and sweet crops in wet ones, provided the land is a gravelly loam. A farmer should not regret having a pasture or two of absolute gravel in his farm, being of excellent use in winter for feeding sheep and lambs with turnips, &c.

The low meadows, whatever the soil, on the banks of the rivers and brooks, are in general good, but often subject to the misfortune of being overflowed in summer, which not only ruins crops of hay before they are cut, but carries them away, perhaps, when just made. Such meadows are also likely to rot sheep put in them during the summer months. A river that does not overflow, running through a farm, is a very favourable circumstance, indicating a probability of the grass fields being well watered—that is, for cattle. Whenever such rivers or streams occur, the power of applying them in irrigation should be most carefully examined.

Another matter of great import in the hiring a farm, is the taking no larger one than the sum of money a man can command will stock properly. A common fault among farmers is, the hiring too much land for their money; they are extremely eager to farm as much as possible. The subject of Farm Capital must, however, remain for discussion till another month.

Michaelmas entries.—Such entries to farms are perhaps the most common in the country. The outgoing tenant threshes out his corn, and either (1) leaves the straw upon the farm, or (2) is paid a consuming price for it, or (3) receives the full market value of it,

according to the terms on which he entered to the land. The green crops (potatoes are sold) and other roots are (1) consumed upon the land by the outgoing tenant, or (2) they are valued at a consuming price to the incoming tenant, or (3) the cost of producing them, including acts of husbandry and purchased manures and seed, is repaid to the outgoing tenant. The seed and labour connected with the young clovers are valued in the inventory. And where the system of liberal tenant-rights prevails, the incoming tenant will also have to pay for certain portions of the cost of manure, cattle food, &c., purchased and used upon the farm during the last two or three years of the preceding lease, being well repaid by the condition in which the land has been thus handed over to him by his predecessor.

OCTOBER.

The usual weather of this month at a number of English stations is given in the figures of the following meteorological table compiled by Mr. Lowe, of the Beeston Observatory, Nottinghamshire.

The agricultural topics claiming the attention of the farmer in October may include (1) *the cost of horse power*; (2) *the meat manufacture*; (3) *crop cultivation*; (4) *the live stock of the farm*.

I.—COST OF HORSE POWER.

The question of steam power and its cost when applied to threshing and to cultivation has been already discussed (see pages 43, 188, and 443, &c.). The cost of manual labour in different parts of the country has been given at pages 260 and 432, &c. We now propose to state the cost of horse power on the farm.

It was estimated (in a paper recently contributed by me to the *Journal of the Agricultural Society of England*) at about 5*d.* per horse per hour, during which time a pull of about 16,000 to 19,000 lbs. lifted one foot high per minute was effected. The cost of steam power may be put at 2*d.* to 3*d.* per horse power per hour, during which 33,000 lbs. are lifted one foot high per minute. The estimate of the cost of horse power we shall extract from the paper already referred to, but first let us contrast the cost and efficiency of manual labour with these. The following is taken from a paper on the forces used in agriculture read by me before the Society of Arts,

THE WEATHER OF OCTOBER.

LOCALITY.	AUTHORITY.	Mean temperature.	Lowest mean temperature.	Highest mean temperature.	Greatest heat.	Lowest maximum heat.	Highest minimum cold.	Greatest cold.	Average amount of rain.	Smallest amount of rain.	Greatest amount of rain.	Average number of rainy days.	Smallest number of rainy days.	Greatest number of rainy days.	No. of years observed.
Guernsey.....	Dr. Hoskins, F.R.S.	53.7	50.5	55.8	71.0	60.0	47.0	37.0	5.2	1.8	8.6	18	9	24	13
Helston	Mr. M. P. Moyle ...	54.9	51.9	57.5	73.0	64.0	45.0	32.0	4.2	1.1	6.6	16	7	23	16
Exeter	Mr. W. H. Ellis	52.7	51.9	54.4	72.6	65.2	38.9	29.7	3.9	1.2	6.2	22	15	28	8
Ventnor, L. of Wight	Dr. Martin	53.9	49.9	57.4	71.0	61.0	45.0	33.0	4.1	1.2	6.7	17	5	26	21
Worthing, Sussex	Dr. Barker	52.8	48.0	55.7	71.2	59.3	40.4	30.5	4.3	1.6	7.6	17	11	28	9
Clifton, near Bristol	Mr. W. Burder, FRAS	50.4	49.0	52.4	73.1	62.5	34.7	24.6	3.4	2.2	6.1	20	14	25	8
London Royal Observatory	{ The Astronomer Royal, F.R.S. }	49.3	43.9	55.5	75.0	59.0	42.0	26.5	2.8	1.2	4.9	15	8	27	90
Bedford	Dr. Barker, F.R.A.S.	51.1	46.4	53.0	78.5	63.5	36.5	30.0	2.5	1.3	5.2	—	—	—	10
Lampeter, near Cardigan	Rev. Prof. Matthews, M.A. }	50.5	49.5	52.2	71.4	64.5	32.4	23.2	5.0	3.8	6.9	21	11	27	6
Norwich	Mr. W. Brooke, FRAS	48.8	42.0	52.4	74.0	57.0	37.0	25.0	3.2	1.7	6.9	15	8	23	21
Highfield-House Observatory.. }	Mr. E. J. Lowe, F.R.A.S. }	49.4	43.2	55.2	77.5	62.5	32.2	19.4	2.9	0.9	4.7	18	11	25	51*
Oxford Observatory	Rev. R. Main, F.R.S.	49.4	46.3	52.0	70.0	60.2	34.5	21.7	2.8	1.5	5.6	16	12	25	34
Grantham	Mr. J. Jeans, F.R.A.S	49.5	47.1	52.0	73.5	59.8	38.4	25.8	2.9	1.3	5.2	16	11	23	10
Hawarden, Chester	Dr. Moffat, F.R.A.S.	49.2	46.8	50.8	69.0	59.0	41.0	25.5	2.6	1.8	3.5	14	9	21	11
Manchester	Mr. G. Vernon FRAS	48.5	44.6	52.0	72.8	61.5	37.0	24.5	3.3	1.7	5.2	19	15	25	12
Leeds	Mr. H. Denny	50.2	47.0	53.0	76.0	61.0	37.0	26.0	2.4	1.1	4.2	18	8	24	10
York	Mr. Ford	47.9	45.5	50.8	70.0	57.0	34.5	19.0	2.2	1.0	4.6	16	11	23	12
Scarborough	Mr. B. Cooke	49.5	47.9	52.3	64.5	58.0	39.8	27.0	2.2	1.3	3.9	12	5	21	6
Isle of Man	Mr. J. Burman, FRAS	50.2	48.9	52.7	66.9	60.1	36.9	29.6	4.3	3.2	5.9	18	12	24	8
Durham Observatory	Mr. A. Marth, FRAS	47.1	44.5	50.7	69.6	56.0	36.1	26.1	2.6	0.3	4.6	16	8	27	14
North Shields	Mr. R. Spencer	47.9	45.9	51.8	69.0	57.0	38.0	24.0	3.1	0.7	7.8	18	7	27	16
Silloth	Rev. F. Redford, FRAS	49.2	47.2	53.8	73.2	63.0	38.3	21.1	3.6	1.5	6.9	15	8	23	7

* Observations at Highfield House on temperature extend over fifty years, and at the Royal Observatory over ninety years.

in January, 1859, and since published in a little "Handbook of Farm Labour:"*—

The following four instances illustrate the cost of manual labour engaged in mere work, *i.e.*, where the least degree of skill is called for.

(1) A man will dig 8 perches of land, or say 2000 square feet nearly a foot deep in a day. In doing so he lifts probably three-quarters of it through about a foot in height, that is to say, he lifts 1500 cubic feet, weighing at least 150,000 lbs. one foot high in 10 hours' time, and to do it therefore he must maintain upon the average a lift of 250 lbs. per minute all that time. Of course in addition to the mere lift there is the labour of cutting off this earth from the firm ground to which it was attached. In my second case, then, this portion of his labour is very much reduced. (2) Three men will lift 100 to 120 cubic yards of farm-yard dung, and fill it into carts in 10 hours' time. The 33 to 40 cubic yards which fall to each man's share, at 12 to 14 cwt. a piece, weigh 50,000 lbs., and this is lifted over the edge of the cart, or 4 feet high—equal to 200,000 lbs. lifted daily 1 foot high, or 330 lbs. per minute. This is one-fifth more than in the last case. (3) Now, take a third instance, in which there is no labour in detaching the weight from any previous connexion:—A man will pitch in an hour's time an acre of a good crop, tied in sheaves, to an average height of full 6 feet, on the cart or waggon. Straw and corn together such a crop will weigh more than 2 tons, say 5000 lbs. In doing this he therefore lifts 300,000 lbs. 1 foot high in 10 hours' time, or 500 lbs. per minute. (4) My fourth case is of much the same kind. One man and 5 boys or women, equal as regards wages, and I will therefore assume equal as regards power, to three men, will throw into carts upon an average of swedes and mangold wurzels 3 acres of a good crop, say 70 tons in all, in a day of 9 hours' length. They lift these 150,000 lbs. 4 feet, being equal to 600,000 lbs. 1 foot; or 200,000 lbs. a-piece in nine hours' time, which is about 370 lbs. a minute.

These four cases indicate the mere force of a man, then, at a cost of say 3*d.* an hour, as equal to a lift of 250, 330, 500, and 370 lbs. per minute; the two former being cases where the load has to be detached as well as lifted, and the third being performed under the influence of good harvest fare.

But now compare this even in its best case with the duty of the steam-engine, namely, the lift of 33,000 lbs. 1 foot high per minute for 3*d.* or even less per hour; and compare it with the actual average performance of the horse, 16,000 to 19,000 lbs. lifted 1 foot per minute for 5*d.* an hour. In order at the best rate named to do the work of the steam-engine, 66 men would be required, at a

cost not of 5*d.* but of more than 15*s.* per hour; and in order to do the work of the horse 32 men would be needed at a cost of 8*s.* instead of 5*d.* an hour. It is plain that if we can take much of the mere labour of the farm out of the hands of the labourer, and put it into the hands of steam power for its performance, there is an enormous amount of saving to be made in the cost of agricultural production. It is plainly folly in the labourer to think that as regards the *mere* labour of the land he can compete with either steam power or horse power. It is in the cultivation not so much of mere strength of body as of skill and intelligence that the safety of the labourer lies, and in his capability of education he is perfectly secure.

It is, however, in the application of the more economical powers to the labour of the farm—the more economical and the more efficient powers, as steam in place of horses, and either in place of men—that the increase of farm profit is likely to be for the most part made.

The following estimate of the cost of horse-power is taken from the *Journal of the Agricultural Society* and the “Handbook of Farm Labour,” to which reference has already been made. Tables have already been given, at pages 58 and 284, of the cost of food given in a number of different farm stables during the different seasons of the year. Adding up the amounts of food given weekly during a certain number of weeks at each season, we learn that the annual cost of food in the several stables varies from 18*l.* 18*s.* to as much as 26*l.* per annum for each horse. And we have other statements to compare with them, indicating an even greater annual expense. Thus, Professor Low gave, as the food of the farm horse, per annum, oats, 125 bush.; hay, 36 $\frac{3}{4}$ cwts.; green food, clover, &c., 5*l.*,—equal to 28*l.* 15*s.*: Mr. Melvin, of Ratho, gives, oats, 132 bush.; bran, 5 cwts.; barley, 24 bush.; grass, 3 tons; turnips, 3 tons; pasture at night 3 months,—costing in all, 30*l.* 16*s.*: Mr. Baker, of Writtle, gives oats, 64 bush.; hay, 40 cwts.; grass, &c., 7 tons; beans, 20 bush.,—equal to 24*l.* 2*s.*: Mr. Gibson, of Woolmet, gives, oats, 85 bush.; turnips, 58 cwts.; potatoes, 58 cwts.; grass, &c., 22 weeks at 5*s.* 3*d.*,—equal to 22*l.* 17*s.* 6*d.*: Mr. Mechi gives, oats, 68 bush.; grass, &c., $\frac{1}{2}$ acre; red clover, 2 $\frac{1}{2}$ acres; hay, 2 tons,—equal to 30*l.* 4*s.*

A review of the tables already given shows that the differences in the cost of weekly food, according to the various modes of feeding specified, are very considerable; amounting to more than 100 per cent. in the cost of summer feeding, which averages 8*s.* a week, and varies from 5*s.* to 11*s.*; to 70 or 80 per cent. in the cases given of autumn feeding, which costs on the average about 9*s.* 6*d.*, and varies from 7*s.* 6*d.* to 12*s.*; to more than 100 per cent. in the cost of winter feeding, which averages about 6*s.* 4*d.*, varying from 4*s.* 9*d.*

to 12s.; and to 30 per cent. in the cost of spring feeding, which averages nearly 10s. a week, varying from 7s. 6d. to 12s.

I find that the average cost per week of keeping a horse throughout the year, according to the cases thus described, and putting the summer season down as lasting 18 weeks, the autumn as 6 weeks, the spring as lasting over 12 weeks, and the winter season as 16 weeks, amounts to about 8s. weekly.

It is the differences in the annual cost per head incurred under different modes of management in the maintenance of the horses of the farm, to which attention will especially be given. Mr. Sandford, whose name appears in the tables already given, pays 16l. 6s. per head per annum; Mr. Melvin pays 30l. 16s. per annum—nearly twice as much. One must not too confidently infer from such a difference per head a similar difference in the cost of horse labour *per acre*. The less expensive method is not necessarily the cheaper of the two, as these very farms sufficiently illustrate. In Mr. Sandford's case 12 horses are used (consuming, therefore, 195l. 12s. worth of food), or 16s. 3d. per acre in cultivating 240 acres of "a marl on a chalk subsoil, from 6 to 7 inches deep." In Mr. Melvin's case, 20 horses are employed (consuming, therefore, 616l. worth of food per annum, or about 18s. 9d. per acre) in cultivating 675 imperial acres, "part of it 8 to 11 inches deep, the rest say 7 or 8—the lea furrow being 6 inches deep." It is right to add, that Mr. Sandford's farm includes 60 acres of grass land, which, however, does not greatly add to the labour of the horses. But the difference between 31l. and 16l. 6s. (90 per cent.) does not merely dwindle down to one between 18s. 9d. and 16s. 3d. per acre (15 per cent.); it still further diminishes, when considered in connexion with the quantity and laboriousness of the fallow crops in the two cases respectively, which are referred to in a following page.

Besides the food of the horse, there is the cost of blacksmith's, saddler's, and farrier's bills, the annual loss of value by increasing age, the wages of horse men and stable boys, and the tear and wear of the implements by which the horse power is utilized in cultivation, to be taken into account; there is also the number of horses with their men kept upon the farm, which are to be considered before we can estimate the cost of horse power per acre on the farm. The extras enumerated above may be valued thus per horse:—Blacksmith's bill for shoeing, and repairs of implements, 30s. annually; farrier's bill, per annum, 10s.; saddler's bill, per annum, 10s.; depreciation of value, 10 per cent., say 3l., the whole thus reaching 5l. 10s. per annum.

In justification of these estimates, I may add here notes by one or two practical farmers, to whom the question had been submitted:—

(a) "Since I joined my father in my present occupation in 1841, I have the account of horses purchased; and as our practice has

been to buy only for making up our teams, and, with only one exception, at an age to be put to work immediately bought, so that nothing is chargeable to keeping, and I consider our present team superior to what I commenced with, it is, I think, a very fair criterion.—Our blacksmith's bills include work done to machinery and fencing, &c., which does not properly belong to horse labour.—Our shoeing will be very much less than in most localities. [It is a fen soil.]—The saddler's account, you will see, is in excess: it includes harness for gig and riding.—The implements are far below your estimate, though I think mine are in good order, and fully capable of well working our occupation. I have not employed either a wheelwright or blacksmith on the premises, so that all my expenditure has come in bills, and it is very easily ascertained. Our total expenditure for seventeen years is as follows:—

	Horses.	Farrier.	Blacksmith	Saddler.	Implements.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
	678 18 0	50 12 0	370 15 7	244 13 9	550 15 0
Average per Annum, say	40 0 0	3 0 0	22 0 0	14 10 0	32 0 0

—The extras you charge 5*l.* 10*s.* would in our case, reckoning for twenty horses, only amount to 4*l.*; that is, 2*l.* per horse for depreciation, 3*s.* for farrier, 1*l.* 2*s.* blacksmith, 15*s.* saddler. On further consideration, I should be inclined to put the charge for extras at 4*l.* 10*s.* per horse.”

(b) “Your estimate of extras approximates very near to what I see mine cost. The following is the amount of my extras for the last four years:—

	Saddler.	Blacksmith's Contract.	Farrier's Contract.
	£ s. d.	£ s. d.	£ s. d.
1855	19 7 0	36 0 0	7 0 0
1856	14 4 6	36 0 0	7 0 0
1857	12 0 0	36 0 0	9 0 0
1858	15 12 0	36 0 0	7 0 0
	61 3 6	144 0 0	30 0 0
Per annum	15 5 10	36 0 0	7 10 0
Per horse ÷ 22	0 13 10½	1 12 9	0 6 10
Amount in all.....		£2 13 5½	
Add for annual depreciation		3 0 0	
Total amount		£5 13 5½	

to which you are sufficiently near.”

In addition to the expenditure in shoeing, saddlery, and the other items specified, the annual tear and wear of implements has to be considered. This may be put at ten per cent. of the value of the implements, which being estimated at 20*s.* per acre over the arable land, results in a charge of 2*s.* per annum on this account.

Lastly, the wages of team men constitute an important extra in the use of horse-power. In the following table the actual wages

VALUATION OF HORSE LABOUR.

1 No.	2 Annual Cost per Horse.		4 No. of Horses.	5 Total.	6 Annual wear of Imple- ments.	7 Wages of Team- men.	8 Total Cost of Horse- Labour.	9 Acreage.		11 Fallow Crops.	12 Acreage.		13 Clover, &c.	14 Pulse, &c.	15 Cost per Acre of Horse- labour over the Arable Land.		16 the Ploughed Land.
	Food.							Pasture.	Arable.		Grain Crops.	Clover, &c.			the Arable Land.	£ s. d.	
	£ s.	£ s.															
1	22 11	4 10	20	541 0	32 0	300 0	873 0	...	660	119	330	110	...	...	1 6 6	1 11 9	£ s. d.
2	24 0	5 10	20	590 0	70 0	332 0	992 0	400	560	110	280	140	...	...	1 15 5	2 7 2*	£ s. d.
3	18 5	5 10	11	261 5	40 0	170 0	471 5	43	400	91	182	85	42	...	1 3 6	1 10 0	£ s. d.
4	23 8	5 0	8	225 4	31 0	176 0	432 4	110	310	78	155	57	20	...	1 7 10	1 14 0	£ s. d.
5	26 6	5 10	5	159 0	12 16	85 0	256 16	41	128	32	54	37	5	...	2 0 0	2 16 5*	£ s. d.
6	18 7	5 10	7	166 19	20 0	104 0	290 19	400	210	50	100	50	...	...	1 9 0	1 18 9*	£ s. d.
7	18 0	5 10	7	164 10	20 0	116 0	300 10	100	200	50	100	50	...	...	1 10 0	2 0 0	£ s. d.
8	19 6	4 10	12	285 12	33 0	170 0	488 12	120	330	77	175	68	10	...	1 10 6	1 17 4	£ s. d.
9	21 4	5 0	7	183 8	25 0	120 0	328 8	60	250	63	125	42	20	...	1 6 3	1 11 7	£ s. d.
10	20 0	5 10	12	306 0	30 0	132 12	468 12	...	300	75	150	75	...	...	1 11 3	2 1 9	£ s. d.
11	26 3	5 10	11	348 3	34 0	179 8	561 11	400	340	90	150	45	55	...	1 13 0*	1 18 1*	£ s. d.
12	21 15	5 10	14	381 10	40 0	200 0?	621 10	400	400	120	185	80	15	...	1 11 1*	1 18 10*	£ s. d.
13	24 2	5 10	12	355 4	40 16	170 0?	566 0	274	408	60	174	174	...	...	1 7 9*	2 0 0*	£ s. d.
14	20 4	4 10	29	716 6	90 0	364 0	1170 6	120	900	235	450	150	65	...	1 6 0	1 11 2	£ s. d.
15	24 5	6 5	16	488 0	50 0	219 15	757 15	75	500	120	240	140	...	...	1 10 0	2 2 1	£ s. d.
16	16 6	5 10	12	261 12	24 0	158 4	443 16	6	240	50	120	60	10	...	1 17 0	2 9 3	£ s. d.
17	19 2	5 10	10	246 0	34 0	150 0	426 0	...	300	100	150	50	...	...	1 8 4	1 14 0	£ s. d.
18	19 10	5 10	22	550 0	60 0	291 4	901 4	...	600	150	300	150	...	...	1 10 0	2 0 0	£ s. d.
19	20 8	5 10	20	518 0	90 0	348 16	956 16	...	900	200	340	150	...	...	1 1 6	1 14 0	£ s. d.
20	30 16	5 10	20	726 0	67 10	388 0	1131 10	...	675	125	300	200	50	...	1 13 6	2 7 8	£ s. d.
21	26 5	8 0	7	239 15	30 0	117 0	386 15	...	240	60	120	30	30	...	1 12 2	1 16 10	£ s. d.

* The instances marked with an *asterisk* are those of pasture farms as well as arable. From 3s. to 4s. 6d. per acre for horse labour on the pasture should be deducted from the sums in column 8; and the remainder, spread over the arable land of the farm, will give figures more correct. For example, in the case of No. 2, where the pasture land costs 4s. 6d. an acre for horse labour, the figures 35s. 5d. would have to be reduced to 32s. per acre.

paid to the plough and team men on twenty-one different farms are given, and the other items which go to swell the cost of horse-labour are particularized. Its columns state—(1) the number of the case; (2) the actual annual cost of food per horse in that case; (3) the estimated or the actual amount, given under the head of extras, of blacksmith's, saddler's, farrier's bill for horse, together with the cost of maintaining the value of the animal undepreciated; (4) the number of horses worked upon the farm; (5) the total cost of horse-keep on the farm, as made up of food and "extras;" (6) the cost of maintaining the implements in use at an undepreciated value—viz., ten per cent. upon an estimated expenditure of 1*l.* per acre of the arable land; (7) the amount of wages paid to team men, as calculated from particulars supplied to me; (8) the total cost of horse labour on the farm; (9 and 10) the total acreage of each farm in arable and pasture land; (11 to 14) the acreage of the several crops cultivated on the arable land,—fallow and fallow crops, including bare fallow, turnips, carrots, mangold wurzel, cabbage, &c.—grain, including wheat, barley, oats, &c.—clover, including clover, sainfoin, lucerne, &c.—and pulse, &c., including beans, peas, and flax; (15 and 16) the cost per acre of arable land, and per acre of the actually ploughed land, of the horse labour of the farm.

It may be stated here, in explanation of the large amount of extras under No. 21, that they included in that case a considerable portion of the cost of implement repairs. The wear and tear of implements also, however, stand rather higher here than in the proportion which the others present to their respective acreage: the fact being, that on this farm a great deal of machinery had been tried, the repairs of which were a heavy item.

Columns 2, 3, 4, 6, and 7, give us, then, the means of calculating the total cost of horse labour on a number of farms, which accordingly appears in column 8.

In columns 9 and 10 we have the acreage occupied by the tenants in the several cases specified. Of course it would be of little service to compare the total cost of horse labour with the total acreage, because much of it might be pasture, involving little labour of any kind. The extent of arable land is accordingly given, and the cost of horse labour is calculated in column 15 per acre of the arable land in every case. But even this would mislead without further explanation, and accordingly in columns 11, 12, 13, 14, will be found the acres respectively in fallow and fallow crops, in grain crops, pulse, and clover. And in column 16 the cost of horse labour per acre ploughed that year is calculated. But even these particulars are insufficient to enable a perfectly truthful comparison, for the soil may be stiff or light, and the cultivation may be deep or shallow.

Take, for instance, one of the last cases (19) in the above table. The farm is an extremely light sand, just enclosed out of the heathy

waste of Sherwood Forest. It is cultivated generally 5 to 7 inches deep, excepting one deep ploughing in preparation for turnips, which is about 10 inches deep; and yet a day's work at plough varies from one acre of deep work, to $1\frac{1}{2}$ or even more of light fallow ploughing. The average of all sorts will be at least $1\frac{1}{4}$ acre done daily per pair of horses in 8 or 9 hours. No wonder that horse labour costs less per acre here than elsewhere, whatever the method of stable feeding may be; for heavy land cannot of course be cultivated for the same expenditure as light and sandy soil. In order, then, that the figures of these last columns of this Table may be read intelligently, I add one or two extracts from the reports of the several farms, stating the ordinary depth of cultivation adopted in the several cases, and the character of the soil.

No. 1. "The soil is peat upon clay, over one half of the farm; over the remainder the clay is ploughed up, and it needs a great deal of rolling to give it sufficient solidity for the wheat crop. The ploughing may be averaged for a pair of horses to do $1\frac{1}{4}$ acre daily. The general depth of cultivation is 5 inches; for, though we plough deeper for fallow, yet the peat decomposes, and we lose the depth in the course of a year, and we find it prejudicial to any other crop to plough deeper than it was fallowed."

No. 3. "Two hundred and sixty acres are a useful marl with stones; the soil deep enough to allow of 7-inch ploughing, and sufficiently retentive (often containing 50 or 60 per cent. of clay) to render it stiff working land in moist weather. One hundred acres are of a light and shallower soil, sometimes occupying the slopes of the hills, where we may not have more than 2 inches of earth. Forty acres are a strong clay marl. Three horses in line are needed for 6 to 7-inch ploughing. From 1 acre (lea ploughing) to $\frac{3}{4}$ (in winter) is a day's ploughing."

No. 6. "Of the soil, 20 acres are light and shallow, resting on limestone rock; 100 are a lightish sandy loam; and 80 are a clayey loam. We plough a foot deep for roots, 4 inches deep for corn."

No. 14. "The soil on the fen farms is very light and non-adhesive; on the high lands more tenacious and heavy. Many fen farmers break up a good deal of their clean fallow lands with 4 or 6 horses in a large plough, bringing up the subsoil and mixing it with the top soil. They plough from 14 to 15 inches deep; but the usual depth of ploughing is for wheat 5 or 6 inches; and on the high lands we cultivate from 6 to 8 or 9 inches deep. Two horses easily plough 5 roods a day on the fen; on the high lands early in the season 2 horses will plough from 3 to 4 roods per day; but in winter and spring, when the land gets wet and sticks a good deal, we usually plough with 3 horses at length, to avoid treading, and they plough just 3 roods daily."

No. 15. "Three-fourths of the farm are a light chalky soil, the

remainder a rather stiff red gravel resting upon the chalk. The wheat stubbles are usually ploughed about 7 inches deep in the autumn by 3 or 4 horses. The average depth for wheat, barley, &c., is about 5 inches. An average day's work is a statute acre, done by a pair of horses abreast."

No. 19. "Soil varying from mere sand to gravelly sand, and in places many boulders. The depth of cultivation varies according to crop from 5 to 7 inches, except one deep ploughing in preparation for turnips from 10 to 11 inches. A day's work at plough varies from 1 acre of hard work to $1\frac{1}{2}$ or even more of light fallow ploughing; ploughing clover lea for wheat $1\frac{1}{4}$ acre per day; and perhaps the average ploughing of all sorts is $1\frac{1}{4}$ acre daily, done in 8 or 9 hours—2 horses to a team."

Even the extremely various character of the land, and the great differences in the treatment of it, as above described, fail, however, to account for the whole of those differences in the price of horse labour per acre which this Table describes. There is a large remainder after the amplest deduction on this account, which must be put down either to varying stable management on the one hand, or to varying laboriousness of cultivation on the other. The number of acres cultivated per horse—*i.e.*, excluding from the whole acreage of the farm, not only the permanent pasture land, but the extent in clovers and grasses—varies exceedingly; no less, indeed, than from 18 and 15, in the case of Nos. 5 and 16, to 31 and 30 in the case of Nos. 4 and 21. From the accounts which have been given me, there does not appear to have been that greater laboriousness of cultivation, either involuntary, arising from the character of the soil, or voluntary, arising from deeper and more frequent cultivation, which would explain such differences as appear in these tables. The further information which is to be extracted from a study of them must be left to be gathered by the reader, but it is worth while pointing out to him how the number of horses kept on a given extent of land overrules in its ultimate effect the most economical style of stable management.

It may be added, as presenting the total result of the instances specified in this table, that we have on 21 farms 282 horses, costing for food, for depreciation of value, and for saddlers', farriers', and blacksmiths' bills, 7713*l.* a year; their implements cost 874*l.* a year to keep them good; and the ploughmen and boys employed about them cost 4242*l.* a year in wages;—in all, about 13,000*l.*, or 46*l.* per horse per annum; and supposing that there are 2500 working hours in the year, this is rather less than 5*d.* per horse per hour.

Cost of Horse Power per Cwt. of Draught.—The common definition of horse power is the ability to lift 33,000 lbs. 1 foot high per minute. This is perfectly consistent with the results of such

experiments on the draught of ploughs as have been published. Thus, when two horses pull a plough along at the rate of $2\frac{1}{2}$ miles in an hour, and the tension on the draught chain is equal to a lift of 300 lbs.—no uncommon case—they do in effect lift that 300 lbs. 220 feet per minute, that being the sixtieth part of $2\frac{1}{2}$ miles; and this is equivalent to a lift of 66,000 lbs., or just the 33,000 lbs. apiece, 1 foot high per minute, which is the ordinary mechanical expression of 1-horse power. This power, however, is not continuously exerted. The plough, though drawn at the rate of $2\frac{1}{2}$ miles per hour, is not drawn 25 miles in a day of 10 hours; it is not often drawn much more than 10 miles in that time, in consequence of loss of time on head-lands, &c. In fact, the plough is drawn barely 10 miles in turning over one acre in furrow-slices 10 inches wide. In this lies one great difference between animal and steam power, namely, the persistence of the latter, if only methods of continuously employing it can be devised. The really effective work of a horse per diem thus does not much exceed one-half of that calculated from its work per minute; and its annual performance must be often still further reduced below the theoretical standard by the occurrence of days when it remains idle in the stable.

In some of the instances described above, I have received such a detailed account of the work done upon the farms, as enables me to estimate with some confidence the *total* annual draught accomplished during its cultivation. The following, for instance, were the details of cultivation on my father's farm at Whitfield (No. 21 in the table, page 515). On 120 acres of it wheat was annually grown: the cultivation of this consisted of 1 ploughing, 3 harrowings, 1 drilling, 1 rolling, the carting of the produce (2 tons per acre) $\frac{3}{4}$ of a mile to the homestead, and the carting of some 100 tons of grain perhaps 6 miles to market. On 60 acres of root-crops there were 1 deep ploughing, and probably 2 shallower ploughings, 3 "cultivat-ings," probably 10 harrowings, 2 rollings, twice ribbing when covering the manure, 1 drilling, 3 horse-hoeings, the carting of 15 tons of dung per acre to the land, and the carting of 25 tons of produce from the land $\frac{3}{4}$ of a mile. On 30 acres of clover there was 1 rolling, and the carting of 15 tons of green food per acre from 10 acres, and the carting of 20 tons of hay off 10 acres $\frac{3}{4}$ of a mile. On 30 acres of beans there were 3 ploughings, 2 "cultivatings," 4 harrowings, 1 drilling, 2 horse-hoeings, 10 tons of dung per acre carried $\frac{3}{4}$ of a mile, $2\frac{1}{2}$ tons per acre of produce carried home $\frac{3}{4}$ of a mile. I have the number of miles walked per acre in performing every operation, and I can from experience and experiment pretty nearly estimate the draught in every case. In the case of produce and manure carried, I add the weight of the cart going and returning, which just doubles the quantity of cartage; and 10 per cent. is charged upon the weight for draught, this being what seems to me

fair, on comparing Mr. Brunel's experiments on this subject with the ordinary character of cartage on a farm.* It is plain that in all these particulars I have the complete history of the labour of cultivating and carrying the crops of the farm, which accordingly is given in the following Table:—

Horse Labour on Whitfield Farm.

Crops.	Acreage.	Ploughed.		Cultivated.	Harrowed.	Rolled.	Ribbed.	Drilled.	Horsehoed.	Dung Carted.		Produce Carted.		Equal to Carrying 1 Mile.
		Deep.	Ordinary.							Tons.	Miles.	Tons.	Miles.	
Roots.	60	60	120	180	600	120	120	60	180	900	$\frac{1}{2}$	1500	$\frac{1}{2}$	1800
Corn.	120	...	120	...	480	120	...	120	...	...	...	240	6	780
Clover	...	...	...	...	...	30	...	...	...	...	...	100	$\frac{1}{2}$	127 $\frac{1}{2}$
Beans.	30	...	60	60	120	...	...	30	120	300	1	150	$\frac{1}{2}$	281 $\frac{1}{2}$
Total . . .	60	300	240	1200	270	120	210	300	...	...	...	...	...	2889
Multiply by the miles walked per acre . . .	8	10	3	1 $\frac{1}{2}$	2	3	2	3	Add for weight of carts ...					2889
Miles walked . . .	480	3000	720	1800	540	360	420	900						5978
Multiply by the draught in cwt. . .	5	3 $\frac{1}{2}$	4	11	2	3	3	1 $\frac{1}{2}$	10 per cent. on which is					
Cwts. of draught . . .	2400	10,500	2880	4500	1080	1080	1260	1350	11,956 cwts. drawn 1 mile.					

These figures represent the cwts. drawn (= lifted) one mile in the several operations; and, adding them together, we have the annual labour of the farm, which amounted, in the case before us, to 37,006 cwts. drawn (= lifted) one mile per annum. For the words "per annum" we may substitute 300 days of 9 hours each, and the work done will be found on calculation to have been equal to the lift of 135,085 lbs. one foot high per minute during all that time; which, as 7 horses were employed, was 19,298 lbs. apiece, or above one-half the theoretical quantity—a very high average, however, as will appear from what I have already said. In order to ascertain the cost of horse-power in this case, we must assume a rate of movement natural to the draught animal—say 2 $\frac{1}{2}$ miles per hour. The work done was 37,006 cwts. drawn (= lifted) one mile in 2700 hours: this is equivalent to 14,802 cwts. drawn 2 $\frac{1}{2}$ miles in 2700 hours, or 5 $\frac{1}{3}$ cwts. drawn that distance every hour. But the cost of horse labour on this farm was 386 $\frac{1}{2}$ 15s. per annum, or 2s. 10d. per hour—that then was the cost of drawing (= lifting) 5 $\frac{1}{3}$ cwts. 2 $\frac{1}{2}$ miles in that time. Horse power on Whitfield Farm thus cost as nearly as possible 6d. per cwt. drawn 2 $\frac{1}{2}$ miles at that

* He found that the draught on a dry good road was 3 per cent. of the weight; on a wet good road it was 4 per cent.; on hard compact loam it was 5 $\frac{1}{2}$ per cent.; on ordinary bye-roads it was 10 $\frac{1}{2}$ per cent.; on a newly-gravelled turnpike-road it was 14 $\frac{1}{2}$ per cent.; and on a loose sandy road it was more than one-fifth, or 20 per cent. of the weight.

rate of movement. If the ploughing of an acre was equal to lifting 3 cwt. 10 miles, then by horse-power it was done for 6s.; if it was equal to lifting 5 cwt. 8 miles (I name fewer miles, because the greater draught implies greater depth of ploughing, and deeper ploughing involves a wider furrow-slice), then it costs 8s. per acre. And these are the figures with which, if it were desired to ascertain the gain of substituting the power of steam for that of horses, an engineer would have to compare the performance of his engine.

Take now the case of Mr. Melvin's farm, No. 20 in the table. In order to understand some of the figures in the cartage columns of the following table, it is necessary to extract the following particulars from Mr. Melvin's report. "There are 1600 tons of manure carted 2 miles. Three-fourths of the grain is carted 10 miles, one-fourth $3\frac{1}{2}$ miles; 48 tons of linseed or other cake are carted 12 miles; 120 tons of coal are carted 11 miles."

Horse Labour on Mr. Melvin's Farm.

Crops.	Acreage.	Ploughed.		Cultivated.	Harrowed.	Rolled.	Ribbed.	Drilled.	Horsehoed.	Dung Carted.		Produce Carted.		Equal to Carting 1 Mile.
		Deep.	Ordinary.							Tons.	Miles.	Tons.	Miles.	
Potatoes	30	Acrs. 30	Acrs. 60	Acrs. ...	Acrs. 180	Acrs. 30	Acrs. 90	Acrs. ...	Acrs. 60	Tons. 660	Miles. $1\frac{1}{2}$	Tons. 180	Miles. 4	Tons. 1545
Turnips	95	95	95	95	950	190	190	95	285	1615	$1\frac{1}{2}$	1800	$\frac{1}{2}$	2920
Beans.	50	...	50	50	400	50	100	...	50	850	$1\frac{1}{2}$	{ 125 36 12 225 75 150 80	{ 10 3 3 10 3 10 10	{ 1620 2870 987
Corn	300	...	300	...	1800	300	...	...	...	30	12	...	...	...
Clover &c. }	50	...	...	...	...	50	...	...	...	...	...	...	...	...
Pasture	150	...	...	...	...	...	...	...	{ Dung Coals Cake	1600 120 48	2 11 12	...	...	3200 1320 576
Total.	675	125	505	175	3330	620	380	95	395	...	...	...	...	15,038
Multiply by the miles walked per acre . . .		8	10	3	$1\frac{1}{2}$	2	3	3	3	Add for weight of carts...				15,038
Miles walked		1000	5050	525	4162	1240	1140	285	1185					30,076
Multiply by the draught in cwt. . .		5	4*	4	3	2	3	1	$1\frac{1}{2}$	10 per cent. on which is				
Cwts. of draught . .		5000	20,200	2100	12,486	2480	3420	285	1777	60,152 cwt. drawn 1 mile.†				

These figures, let me repeat, represent the cwt. drawn (= lifted) one mile in the course of the several operations annually; and adding them together, we have the annual labour of the farm equal to 107,900 cwt. drawn (= lifted) one mile per annum; or substituting

* Mr. Melvin's ordinary depth of ploughing is somewhat greater than it was on Whitfield Farm, and I estimate the draught a little higher. Two ploughings are put down against potatoes—the labour of ploughing them up, &c., being assumed as equal to one.

† I would have reduced the per-centage here, as so much of it is on the turnpike road, but Mr. Melvin's farmstead is on a height, which makes the draught heavier than it would otherwise be.

for the year 300 days of 9 hours each, the work done will be, according to calculation, equal to the lift of 393,875 lbs. one foot high per minute during all that time, which, as 20 horses are employed, is 19,693 lbs. apiece, somewhat more than on Whitfield Farm, and a very high average performance indeed. The work done annually corresponds to 43,160 cwts. lifted $2\frac{1}{2}$ miles per annum, or 15.98 cwts. per hour during the year. Now Mr. Melvin's horse-labour costs him 1131*l.* 10*s.* a-year, or 8*s.* 4*d.* per hour during the year. Horse-power in his case then costs rather more than 6*d.* per cwt. drawn (= lifted) $2\frac{1}{2}$ miles, at the rate of movement specified. If his horses walk 8 miles in ploughing an acre with a 5 cwt. draught (which indicates very deep and heavy work), the work is done for 8*s.* per acre.

It is plain that the instances I have given must be taken rather as illustrations of the mode of calculation to be adopted, than as conveying what is absolutely true of the two cases specified. That there are many unavoidable liabilities to error in these calculations I readily admit; but that they give an approximation to the truth will, I suppose, be generally admitted.

If you can enumerate all the operations on your farm, together with the draught incurred in accomplishing them, then you can easily convert the whole into weight lifted through a certain space in a certain time. If you can record the cost of horse food, of extras, of ploughmen, and of keeping up live and dead stock, then against the work done you can place the exact cost of doing it; and the comparison leads, as in the two cases worked out above, to the cost of horse power "per cwt. of draught, at a given rate of movement."

It would be tedious to examine in detail the other instances given in the Table; but I may add here, as the result of such an examination, that I believe the following Table describes pretty nearly the experience of those whose names are given:—

Number on Table.	Name.	Performance per Horse, i.e. lbs. lifted 1 foot per minute.	Annual Labour.		Cost of horse labour		Cost of horse power per cwt. drawn $2\frac{1}{2}$ miles.
			Cwts. drawn 1 mile per annum.	Cwts. drawn $2\frac{1}{2}$ miles per hour.	Per annum.	Per hour.	
		lbs.	cwts.	cwts.	£ s.	s. d.	d.
1	Aitken...	18,250	100,000	14.8	873 0	6 5 $\frac{3}{4}$	5 $\frac{1}{2}$
3	Coleman.	14,354	44,000	6.5	471 5	3 6	6 $\frac{1}{2}$
9	Laidlaw*	16,052	30,800	4.5	328 8	2 6 $\frac{3}{4}$	6 $\frac{1}{2}$
19	Wilson...	16,957	93,800	13.88	956 16	7 3 $\frac{1}{2}$	6 $\frac{1}{4}$
20	Melvin...	19,693	107,900	15.98	1131 10	8 4 $\frac{1}{2}$	6
21	Morton..	19,298	37,006	5.5	386 15	2 10	6

* Mr. Laidlaw tells me he sometimes draws 700 or 800 loads of Severn mud $1\frac{1}{2}$ miles in the course of the summer; and this is here added to the work of the farm, and does of course increase the performance of his horses.

These figures, let me repeat, are necessarily mere approximations to the truth. They are given, of course, without regard to any personal bearings they may have, simply as the results to which calculation, on the data furnished to me, has led. No doubt exception may be taken to many of them; they may, however, be safely taken, both as illustrating the way in which the cost of horse-power must be calculated, and also as showing that very considerable differences do exist in the expense of horse labour as it is managed on different farms.

The whole statement is given here, as being proper for publication in a work which aims at completeness as a picture of English agriculture. It is extracted from the paper in the *English Agricultural Society's Journal*, already named; sundry corrections being adopted which appeared in the report of it in the "Handbook of Farm Labour."

II.—THE MEAT MANUFACTURE.

The productiveness of the meat manufacture depends, as was illustrated by me at some length in a paper published in the 11th volume of the *English Agricultural Society's Journal*, (1) on increasing the fertility of the land; (2) on giving expression to that fertility by the selection of the best plants for cultivation; and (3) on selecting the best animals for the consumption of those plants. I shall take from the essay I have referred to passages relating to such of the points as have not already been discussed in these pages.

(1) **Grass Land v. Arable, as producers of Meat.**—Land yielding 12 or 15 tons of green food per acre yearly without any labour but that of repairing the fences which divide it, destroying the docks and the thistles which invade it, and supplying manure to maintain it, is producing more at less expense than perhaps it could do in any other condition. It is not in such cases as this, then, that our comparison must be made: there is much *poor* pasturage in the country, which lies, nevertheless, under a climate proper for arable farming; and it is about this that the question obtains.

There is no doubt that over much of this which, though drained, would not yield 30 tons of green food per acre in four years, an equal quantity might, if it were properly cultivated, be obtained in turnips and clover, with probably 2 tons of straw and 60 or 70 bushels of grain in the same time. Grass is probably more nourishing per ton than turnips; but when the one is consumed in all weathers by unsheltered animals, and the other in well-bedded houses, it may be doubted whether the resultant produce of meat may not be about the same in either case—with a clear balance, of course, of so much grain as food for man in favour of arable culture. But this matter requires a detailed estimate, and this I shall endeavour

to give, merely premising that the above figures are not given without reason; as on the farm I write from, three-quarters of which were formerly grass, a stock of about 40 head of oxen fattening to 60 or 70 stones, and between 200 and 300 sheep fattening to 24 lbs. a quarter, with 50 or 60 pigs, are now kept during winter, and about half those numbers during summer, where formerly a herd of 25 cows and about 20 yearling and 2-year-old heifers, with a few pigs, were maintained in store condition; while, in addition to the above, the land now permits an annual sale off it of about 4000 bushels of wheat.

Grass-land worth 30s. per acre of annual rent may be supposed to yield 8 tons of grass per acre per annum: and this may be believed able, by careful consumption, to produce 9 imperial stones of beef; or at 6*d.* per lb. a money value per acre of 18*l.* 18*s.* in six years.

The same land, broken up, would, under good management, yield during—

The 1st year	25 cwt. of wheat straw
2nd „	24 tons of mangold wurzel
3rd „	25 cwt. of wheat straw
4th „	18 tons of Swedish turnips
5th „	20 cwt. of barley straw
6th „	10 tons of clover—

or 52 tons of green food, and 3½ tons of litter, in six years, beside the produce of grain.

Of course it is easy so to state figures as to arrive at any result that may be desired; but in the above I have gone upon what I believe to be reasonable data, viz.:—

That 24 or 25 cwt. of hay is a probable produce from land of such value;

That hay is one-fifth or more of the grass from which it is made;

That the growth of aftermath is to the growth up to hay harvest as 1 to 3 on such land.

We know from experience that turnips consumed without any artificial food, as it is called, given with them, will not generally yield more than 1 lb. of beef or mutton for every 150 lbs. of green food; and giving grass credit for a little more nourishment than this, we have assumed that 140 lbs. of it will yield the same meat.*

* The best grazing land in Lincolnshire we are told, on first-rate authority, will, under the best circumstances, feed an ox and a sheep from New May-day till Old Michaelmas. The former will gain 20 stone, or 280 lbs., and the latter 10 lbs. a qr., or 40 lbs. in the time. The acre will thus yield 320 lbs. of meat. Its produce of grass may be 16 tons—perhaps more. This is 1 lb. of meat for every cwt. of grass, but we must remember that the grass of such land differs from the average in the quality as well as the quantity of its produce.

On the side of arable land, again, I have stated amounts of produce which from several years' experience I know to be probable.

The 52 tons of green food (supposing the straw to be all used as litter) will on the above datum yield 776 lbs. of beef, and this at 6*d.* per lb. is worth 19*l.* 8*s.*, an amount rather larger than that which was the whole return from the grass, while here we have in addition the produce of three crops of grains. Whether the whole extra expense of this mode of managing the land will be more than paid by this extra produce is hardly within the province of this inquiry.

It is hardly worth while considering the case of arable land wholly devoted to meat-producing crops, and we therefore go on to compare in this respect the various rotations of crops commonly adopted.

If a cultivation wholly of green crops, or of crops for consumption by cattle on arable land, would pay, it would be a source of immense wealth in many parts of Ireland, where waste-land reclamation proceeds so slowly mainly because of the unprofitableness of corn cultivation under their watery skies. The results of the above estimate, however, must be the standard with which to compare the productiveness of grass, and it has been seen that the former, besides the large crops of grain on the arable land, yields more meat than the latter. The conclusion which therefore seems to be unavoidable is, that in cases when equal skill and care have been brought to bear both on arable and pasture farming, the latter might be converted without diminishing, and probably with an increase to the national supply of animal food.

(2) **Various Rotations as producers of Meat.**—(a) The first, the Norfolk, or four-course rotation, may be supposed able to yield in the

First year	25 cwt. of wheat straw per acre
Second „	19 tons of Swedish turnips
Third „	20 cwt. of barley straw
Fourth „	11 tons of clover and grass.

This is equal to 30 tons of green food in 4 years, or $7\frac{1}{2}$ tons per acre per annum, a quantity which, at the rate of one for every 150 lbs., is able to produce about 1 cwt. of beef per annum.

(b) In the second, when this rotation is extended one year by keeping the grass down 2 years, we may suppose a somewhat larger acreable produce of green crop. Thus—

First year	25 cwt. of wheat straw
Second „	20 tons of swedes
Third „	20 cwt. of barley straw
Fourth „	11 tons of clover
Fifth „	9 tons of clover.

Giving 38 tons as the produce of 5 years, or nearly the same acreable produce per annum as in the former case.

(c) We now may take the Dunbar six years' course of crops as our third rotation, and here we may expect—

First year	20 tons of swedes
Second „	20 cwt. of barley straw
Third „	12 tons of clover
Fourth „	25 cwt. of wheat straw
Fifth „	25 cwt. of bean straw
Sixth „	25 cwt. of wheat straw—

which will yield 32 tons of green food, or 478 lbs. of meat per acre in 6 years, a quantity equal to about 80 lbs. per acre per annum.

(d) In our fourth instance we take the eight years' course followed on the farm from which we write. It may produce—

First year	25 cwt. of wheat straw
Second „	25 cwt. of bean straw
Third „	25 cwt. of wheat straw
Fourth „	24 tons of mangold wurzel
Fifth „	25 cwt. of wheat straw
Sixth „	12 tons of clover
Seventh „	25 cwt. of wheat straw
Eighth „	20 tons of swedes—

or, in 8 years, 56 tons of green food, corresponding, according to our original datum, to 104 lbs. of meat per acre per annum.

(e) As regards heavy land rotations of crops, we take the following from an essay on that subject in the 4th vol. of the *Agricultural Journal*. It will produce probably

First year	12 tons of vetches and 16 tons of rape and turnips
Second „	25 cwt. of wheat straw
Third „	12 tons of clover and tares
Fourth „	25 cwt. of wheat straw
Fifth „	25 cwt. of bean straw—

or 40 tons of green food, *i.e.*, about 600 lbs. of meat per acre in 5 years, equal to nearly 120 lbs. per acre annually.

(f) Our last instance shall be selected from Professor Low's work, where it is praised for its suitability to rich clays. It may yield—

First year	Nothing—summer fallow
Second „	25 cwt. of wheat straw
Third „	12 tons of clover
Fourth „	25 cwt. of oat straw
Fifth „	25 cwt. of bean straw
Sixth „	20 cwt. of barley straw.

It thus produces 12 tons of green food in 6 years, or 30 lbs. of meat per acre per annum.

It is proper to remark that the above estimates are more likely to be relatively than positively true; the datum on which their produce of meat is calculated is of course subject to the vicissitudes which affect all agriculture, and stultify all farm estimates: the herd which is to convert this food may be carried off by disease, and its produce of meat will then of course be anything rather than 1-150th the weight of the food. But all the rotations named are liable to this risk alike, and it may therefore be useful to compare them:—

Name.	Period.	Lbs. of meat produced per acre per annum.
<i>a</i> Norfolk	4 years	110
<i>b</i> Ditto	5 "	110
<i>c</i> Dunbar	6 "	80
<i>d</i> ———	8 "	104
<i>e</i> Stace	5 "	120
<i>f</i> Low	6 "	30

Of these the fifth is less likely to realize its estimate than any of the others, as its large produce depends upon the possibility, on an average number of years, of obtaining 16 tons of rape or turnips on a clay soil after a spring crop of vetches, and this is extremely doubtful. Of the fourth rotation—our own—we would only say, that we have grown in a past year 30 acres of clover (15 of them for horses), 30 acres of mangold wurzel, 15 acres of swedes and turnips, 14 acres of carrots and potatoes (of which at least 12 acres have been sold, or eaten by horses), so that on 3-8ths of the farm we have had a produce for consumption of 960 tons of green food; and if *all* had been converted into meat, as it might have been, the produce available for that purpose would have been—

30 acres of clover . . .	=	360 tons
30 " mangold wurzel . . .	=	420 "
15 " swedes . . .	=	300 "
14 " carrots, &c. . .	=	280 "

Total 1360 "

The meat made from 960 tons was as follows:—

70 sheep bought at probably 15 lbs. a quarter were sold	lbs.
at 25 lbs. = 70×40	2800
About 160 sheep bought at 13 lbs. a qr. were sold at	
probably 23 lbs. = 160×40	6400

Total mutton (carried forward) . . . 9200

	lbs.
Brought forward	9200
10 oxen weighing 5 cwt. became 6 cwt. each	1120
20 oxen weighing 6 cwt. became 8 cwt. each	4480
6 cows weighing 5 cwt. became 7 cwt. each	1344
Add say 30 cwt. of bacon and pork	3360
Total meat made	19,504

But at least 240%. worth of food have been purchased, and if it be supposed to have made its worth of meat, which is, by the way, a very doubtful thing, then at 6*d.* per lb. we must deduct at least 9504 lbs. from the amount of meat made, leaving 10,000 lbs. as the produce of 960 tons, or about 13,000 lbs. as the produce of 1360 tons—the produce, in fact, of a farm of 240 acres. This is only about 60 lbs. of meat per acre; it is only 1 lb. of meat produced by the consumption of about 200 lbs. of green food. It is a result, however, probably as near the truth as we can attain; including the circumstances of illness suffered by stock, and of a deduction of the whole value of cattle-food purchased.

In the sixth rotation named, the small produce of meat illustrates the effect of the naked fallow. I believe that there is no more effectual method of increasing our supplies of animal food than the substitution of a green crop, such as the vetch, the cabbage, or the mangold wurzel—all clay soil plants—for the naked fallow. The substitution could be effected without expense, that is, at a cost paid for by the additional returns it would produce; a crop of 24 tons per acre once in 4 or 6 years would be a clear gain of animal food to the amount of 90 or 60 lbs. respectively per acre annually over those districts which admit of the change.

We have thus to recount, as the conclusions to which the second section of our subject has led, that the substitution of green cropping for naked fallows would be cheaply productive of meat: that the rotations in use on arable land vary as much as from $\frac{1}{4}$ of a cwt. to more than 1 cwt. per acre in their produce of meat, and that much therefore may be added to the national supplies by the selection of a good succession of crops: that the conversion of inferior grass land to arable culture, while it would add largely to the supply of human food in the shape of grain, would also to a small extent probably increase the supply of meat.

The fattening process.—Nothing is more variable than the experience of the meat manufacturer, and the above figures must be taken as true of an experience midway between wide extremes. Meat grows cheaply when cattle are treated according to their powers of converting food. To give the same rich food to an ill-bred steer as you would to a short-horn or Hereford ox would result merely in the greater part of it being burned in the lungs of the

animal, and most of the remainder being thrown into the dung-heap. Choose cattle, sheep, or pigs possessed of that tendency to early maturity which good breeding gives, feed them liberally on good food, cooked or crushed or pulped to facilitate digestion, and place them during feeding in warmth and comfort, and they will make meat rapidly and economically.

The greatest success probably is attained when you feed such cattle during summer in loose boxes, giving them fully grown Italian rye-grass and clover, with 2 or 3 lbs. of bean meal over a little hay-chaff daily. In September and October gradually accustom them to Swedish turnips, and continue the hay-chaff, adding to the bean-meal about 1 lb. of linseed-meal boiled to mucilage and thrown over it. When they take to Swedish turnips wholly, *i.e.* not more than $\frac{3}{4}$ of a cwt. daily a-piece—give them in addition 8 or 12 lbs. of this hay-chaff, 1 or 2 lbs. of linseed-meal, and 3 to 5 lbs. of bean-meal in addition daily, according to their size. In spring gradually displace the swedes by mangold wurzel. And if the food is ever distasteful to them change it—as linseed and beans for oil-cake, &c.

It is the most recent experience that roots should be pulped and mixed with chaff a day or so before being used.

Whether or not the advantage of pulping is derived from its inducing a larger consumption of straw first cut and mixed with the pulp, than when offered to cattle uncut, it is decidedly an advantage to the arable farmer, for a large quantity of straw is on ploughland generally used wastefully in litter, and a portion of it will be saved for use as food with economy and profit.

The following memoranda on this subject, extracted from contributions to the twentieth volume of the *English Agricultural Journal*, appear to be conclusive on the subject.

Mr. Lawrence, of Cirencester, says:—

“We find that, taking a score of bullocks together fattening, they consume per head per diem three bushels of chaff mixed with just half a hundredweight of pulped roots, exclusive of cake or corn; that is to say, rather more than two bushels of chaff are mixed with the roots, and given at two feeds, morning and evening, and the remainder is given with the cake, &c., at the middle-day feed, thus:—We use the steaming apparatus of Stanley, of Peterborough, consisting of a boiler in the centre, in which the steam is generated, and which is connected by a pipe on the left hand with a large galvanized iron receptacle for steaming food for pigs, and on the right with a large wooden tub lined with copper—in which the cake, mixed with water, is made into a thick soup. Adjoining this is a slate tank of sufficient size to contain one feed for the entire lot of bullocks feeding. Into this tank is laid chaff, about one foot deep, upon which a few ladles of soup are thrown *in a boiling state*; this is thoroughly mixed with the chaff with a three-

pronged fork, and pressed down firm; and this process is repeated until the slate tank is full, when it is covered down for an hour or two before feeding-time. The soup is then found entirely absorbed by the chaff, which has become softened, and prepared for ready digestion.

"We continue the use of rape-cake as the most economical food, notwithstanding all that has been said and written against it. There is doubtless more or less mustard-seed often grown with the foreign rape-seed. The essential oil generated from the former by the chemical action hereafter explained would be injurious to animals; but we have found this adulteration to be rendered quite harmless *when exposed to a temperature of 212°*—the boiling point—and the soup allowed to simmer a few minutes at that temperature before it is thrown over the chaff. Our adoption of rape-cake has been based on the comparative analysis by Dr. Voelcker, given below,* as the average result of his examination of several samples of each. These analyses, it will be seen, exhibit very little difference in the feeding value of linseed and rape cake, while the market value of the one is usually double that of the other. Our experience of the use of rape-cake, thus used, extends over a period of ten years of feeding from twenty to twenty-four bullocks annually. We have not had a single death during that period, and the animals have been remarkably free from any kind of ailment. Rape-cake not being so palatable to animals as linseed-cake, we do not exceed four lbs. per head per diem; and we add in the trough of each animal, with each mid-day feed, two lbs. of mixed meal. We rarely exceed this allowance, excepting in the case of very large oxen; we commence with one lb. of cake per head, and increase this gradually up to four lbs., when we begin mixing the meal.† We have found the cost, on an average, including attendance and fuel, to be 6s. per head per week, exclusive only of the cost of the chaff-cutting. One man and a lad,

	Linseed-cake.	Rape-cake.
* Moisture.....	12·44	10·68
Oil.....	12·79	11·10
Nitrogenized flesh-formers...	27·28	29·53
Heat-giving substances	41·36	40·90
Mineral matters (ash)	6·13	7·79
	100·	100·

† The manufacture of an extended quantity of the best manure being a great object with us, we do not hurry the progress of the cattle to maturity for the butcher; but with animals that do not feed so fast as others, or when we have been later than usual in putting them up, we have added 1 lb. of cake and 1 lb. of meal to the above allowance, and distributed the compounds over four feeds instead of three;—the chaff and pulped roots early in the morning—the cooked food, containing $2\frac{1}{2}$ lbs. of cake and $1\frac{1}{2}$ lbs. of meal—then pulped roots and chaff—and last a second feed of cooked food as before, allowing four hours' interval between each meal.

at 18s. per week, pulp the roots by a hand machine, and feed, litter, clean, and cook the food for twenty-three bullocks, and cut and steam the roots for and feed twenty-four fatting pigs, having the chaff only cut to their hands. This just fully occupies their time."

Mr. Duckham, of Baysham Court, Ross, Herefordshire, says:—

"The advantages of pulping roots for cattle are—1st. Economy of food; for the roots being pulped and mixed with the chaff either from threshing or cut hay or straw, the whole is consumed without waste, the animals not being able to separate the chaff from the pulped roots, as is the case when the roots are merely sliced by the common cutter: neither do they waste the fodder as when given without being cut.

"2nd. The use of ordinary hay or straw. After being mixed with the pulp for about twelve hours fermentation commences; and this soon renders the most mouldy hay palatable, and animals eat with avidity that which they would otherwise reject. This fermentation softens the straw, makes it more palatable, and puts it in a state to assimilate more readily with the other food; in this respect I think the pulper of great value, particularly upon corn-farms where large crops of straw are grown, and where there is a limited acreage of pasture, as by its use the pastures may be grazed, the expensive process of haymaking reduced, and consequently an increased number of cattle kept. I keep one-third more, giving the young stock a small quantity of oilcake, which I mix with the chaff, &c.

"3rd. Choking is utterly impossible, and I have only had one case of hove in three years, and that occurred when the mixture had not fermented.

"4th. There is an advantage in mixing the meal with the chaff and pulped roots for fatting animals, as thereby they cannot separate it, and the moisture from the fermentation softens the meal and ensures its thorough digestion; whereas, when given in a dry state without any mixture, frequently a great portion passes away in the manure."

On the value of the process for a grazing farm with but a small quantity of ploughland, Mr. Corner, of Woodlands, Holford, Bridgewater, thus speaks:—

"My plan is, first commencing with the grazing beasts, to cut about an equal quantity of hay and straw and mix with a sufficient quantity of roots (mostly mangold) to well moisten the chaff; and as the beasts advance in condition, I lessen the straw and increase the hay, and in their further progress I mix—in addition to all hay chaff and roots—from six to ten lbs. per day to each bullock of barley and bean-meal, according to its size; and I have them large sometimes—I sold last week for the London market a lot of Devon

oxen, of very prime quality, averaging in weight upwards of 100 stone imperial each.

"For my horses, cows, yearlings, and oxen—the latter to be kept in a thriving condition, and turned to grass, and kept through the summer for Christmas, 1860—I cut nearly all straw with a very small quantity of hay, and this the offal of the rick. These also have as many pulped roots as will moisten the chaff, except the horses, and to them I give, along with *bruised oats*, just enough roots to keep their bowels in a proper condition. To the two or three year old beasts I give some long straw and a part chaff, and the offal (if any) of the food of the above lots of stock.

"My farm is but a small one, under 200 acres. My predecessor always mowed nearly all the pastures for hay, which is about half the farm, and with this scarcely ever grazed any beasts, and kept but very few sheep. Since my occupation I scarcely ever exceed ten acres of meadow with one field of seeds for hay. I keep from 250 to 300 large-size Leicester sheep, and graze from twenty to twenty-five large size beasts a year, with other breeding stock in proportion.

"I consider the pulping of roots is better for fattening pigs than anything else. My plan is to have a large two-hogshead vat as near the pulping machine as possible, so as to fill it with a malt-shovel as it comes from the machine; at the same time I keep a lad sprinkling meal (either barley or Indian corn) with the roots, and this is all done in fifteen or twenty minutes: it is then ready for use to be carried to the pigs in the stalls alongside the fattening beasts. I never could fat a pig with *profit* until I used pulped roots."

On feeding horses with pulped roots, Mr. Slater, of Weston Colville, Cambridgeshire, says:—

"I give all my cart-horses a bushel per day of pulped mangold, mixed with straw and corn-chaff. I begin in September, and continue using them all winter and until late in the summer—nearly, if not quite, all the year round; beginning, however, with smaller quantities, about a peck, and then half a bushel, the first week or two, as too many of the young growing mangold would not suit the stock. I believe pulped mangolds, with chaff, are the best, cheapest, and most healthy food horses can eat. I always find my horses miss them when I have none, late in the summer. I give them fresh ground every day. Young store-beasts, colts, &c., do well with them; but I do not think they could be used with any advantage with a flock of sheep: they are, however, useful for fattening bullocks, inducing them to eat any food you may wish to give them."

These remarks illustrate the influence of the mode in which food is given upon the economy of the meat manufacture. Whenever the root crop is inferior, or the hay crop badly harvested, the pulper,

for economizing the former, and for enabling the easy consumption of the latter, is a great economy. Steaming food is another great assistance to the feeding. Mr. Lawrence's account of the advantage of steaming food has been already given. The late Mr. Horsfall, of Otley, found the advantage of the practice in the feeding of his fattening milch cows, for he carried on the feeding and the milking of his dairy of cows together.

His winter feeding was remarkably liberal, but he received his return for it in the fattening of his cows at the time they were giving milk. The following is the report to the English Agricultural Society of his management—He had for four years given his dairy cows rape-cake, of the kind termed "green" cake, which imparted to the butter a finer flavour than any other kind of cake; and in order to induce them to eat it, he blended it with one quarter the quantity of malt-dust, one quarter bran, and twice the quantity of a mixture in equal proportions of bean-straw, oat-straw, and oat-shells; all well mixed up together, moistened, and steamed for one hour. This steamed food had a very fragrant odour, and was much relished by the cattle: it was given warm three times a day, at the rate of about 7 lbs. to each cow (or 21 lbs. daily). Bean-meal was also scattered dry over the steamed food, cows in full milk getting 2 lbs. per day, the others but little. He had found this substance to be an unfailing means of keeping up the condition of cows while giving milk. When the animals had eaten up this steamed food and bean-meal, they were each supplied daily with 28 to 35 lbs. of cabbages from October to December, of kohlrabi till February, or of mangolds till grass time; each cow having given to her, after each of the three feedings, 4 lbs. of meadow hay (or 12 lbs. daily). The roots were not cut, but given whole. The animals were twice a day allowed to drink as much water as they desired.—Since the date of this report, Mr. Horsfall discontinued the use of bean-meal owing to its comparative price, and has given in its place, along with about 5 lbs. of rape-cake, an additional allowance of malt combs, and 2 or 3 lbs. of Indian corn-meal per cow. On this food, in instances actually observed, his cows have given 14 quarts of milk a day, and gained flesh at the rate of about one quarter of a cwt. per month.

From an experience of several winters, feeding 60 or 80 head of cattle, both stores and fattening beasts, we can speak in like manner of the advantage of boiling linseed and bean-meal, as thin as a thickish soup, making it salt, and pouring it over a heap of mixed straw and hay chaff, and letting the whole lie until it is thoroughly soaked before being given as food.

Value of Oil-cakes.—This mixed linseed and beans has always proved more economical in the proportion of 1 lb. of the former to 2 lbs. of the latter, than an equal value of English oil-cake given in

the usual way, after being passed through a cake-breaker. It is, however, now replaced, with economy, by the use of rape-cake and of the decorticated cotton-seed cake, the market price of both of which is below what analysis indicates to be their real feeding value.

Dr. Voelcker, in one of his reports to the English Agricultural Society, makes the following remarks on the condition in which various cakes are offered in the market:—

We often forget that animals have appetites as we have, and that they like food in a good condition better than food in a bad one. The composition of two samples of the same food may not vary much; yet the practical effect produced by them may vary exceedingly. Animals never do well on very old cakes. In examining, therefore, the different cakes, we ought to examine particularly their condition. I allude especially to the examination of cotton-cake; the colour affords an excellent criterion as to its freshness. The freshest cotton-cake is as yellow as mustard. As it gets old it gets brown; but the interior is bright yellow—very different from the part that has been exposed to the air. The deeper the brown colour has penetrated, the older the cake, and the more it has suffered by bad keeping. If it is kept in a damp place, its colour and condition are rapidly deteriorated. The best rape-cake is green German rape. I believe it is as good as linseed-cake for store cattle. The difference in their composition is very trifling. The proportion of oil is nearly the same. Some foreign cake, especially Indian cake, is often made of seed which is full of mustard. Several cases of poisoning have occurred from its use. It is a safeguard against mustard seed in cake to steam it before use. Of the specimens which passed through the hands of Dr. Voelcker, the chemical officer of the English Agricultural Society, last year (1860), he reported—

At least three-quarters of all the linseed-cakes examined by me during the past season were either grossly adulterated, or were cakes of quite inferior quality. The practice of recrushing oilcakes and mixing the powder with a certain amount of bran before replacing it into the presses, appears to be gaining ground. Good decorticated cotton-cake has become much dearer, and is bought up as soon as it arrives in this country, and is consequently rather difficult to obtain of first-rate quality. One of the most useful oilcakes is green German rape-cake. Several excellent samples were sent for analysis, and also some samples of common and of Indian rape-cake. The examination of these cakes has strengthened my conviction that whilst green German rape-cake may be used with perfect safety, it is dangerous to give to cattle other kinds of rape-cake, inasmuch as they frequently contain mustard in proportions injurious to animals.

Recently attention has been directed to the probable importation of Egyptian dates in years of plenty. Of the same kind is the locust or carob pod, an importation from the Mediterranean, cou-

taining a good deal of sweetening matter, and useful as a fattening food.

The advantage and the profit of these additions to the ordinary green food, straw and hay, of the farmer, depend a good deal, first, on the quality of the home-grown food, and next, on the quality of the cattle bred or purchased to consume it. The turnip crop of some districts is a great deal more nutritious than it is as grown elsewhere. The experience of Scottish feeders and turnip-growers is thus never realized in England.

Mr. McCombie, of Tillyfour, in Aberdeenshire, says :—

I fat from 300 to 400 beasts annually—my average price for them in London this season has been 35*l.* a-head ; I never exceed 4 lbs. oilcake and 2 lbs. bruised oats a beast per day ; they have what turnips they can consume, and oat straw ad libitum. 12*l.* per acre is my average profit in feeding on Aberdeen yellow and Swedish turnips. I sometimes realize less, often more. This cannot be paralleled in the south, where we often hear that feeding cattle are a necessary evil—necessary for the manure made during the feeding process, but an evil for the *loss* consequent upon it.

Even on the most nutritious of home-grown food, however, and perhaps then more especially, it is profitable in the case of well-bred cattle to add from 4 lbs. to 8 lbs of meal and cake to the daily ration of pulped roots and chaff. But on the quality of the cattle to which this food is given more than any other thing depends the profitableness of the process.

A correspondent on this subject once called our attention to his mode of cattle feeding. He had a lot of small cattle (some of them sold fat at forty-two stones each), fed on half a cwt. of pulped turnips and two lbs. of rape-cake, and twenty lbs. of cut wheat straw daily. "They are always full and seldom on their feet, except at feeding time." The account he gave indicated that they were doing very well ; and he asked—"Do you think the cattle could assimilate a greater portion of nourishment ? I have no wish to have my food pass through them unappropriated by the system."

Now this was a question which we were unable to answer, for the reason just referred to. The elements of the case were not before us. It was not sufficient to say that the food in question contains daily 1½ lb. of nitrogen, 11 lbs. of starch, and ¾ lb. of fat—that the proportion of the nitrogenous to the non-nitrogenous elements is as one to eight—nor even, taking the more practical aspect of the question, that the daily cost of the food is about 5*d.*, while the animals which in January were in "a very lean state," were expected to be "fat by the end of May." The fitness of food depends not on the general consideration of animal nutrition, but on the character of the animals in question, and of that we had no sufficient account. Well-bred short-horn cattle would make the full use of a much richer

diet than the one here specified, while ill-bred mongrel starvelings would waste it.

We had then before us an instance illustrative of this: a flock of mountain sheep from Lancashire had been introduced into one of the southern counties, where, on pastures richer than where they had been bred—on Swedish turnips, too, given to them there—it was expected that their progress would be proportionably faster. This, however, had not been the case. When fed on richer food they became liable to disease, and even when the quality of the feeding was reduced so as to suit their health, the rate of improvement was not so much the quicker as to pay for the greater cost of food beyond what they would have had in Lancashire. The grass and swedes and hay that they had would have made more mutton on the body of a Down or Leicestershire sheep, and have yielded a larger money return though given to the sheep costing it may be 35s. or 40s. each, than to the mountain flock which were imported at a cost of little more than a pound a head.

The same holds true in other breeds and animals. The feeding which we hear of as given to well-bred short-horn steers in the feeding-yards of Yorkshire, Lincolnshire, and Norfolk, may be profitable there, and wasteful under other circumstances. Shelter, warmth, and quiet are profitable everywhere, and nutritive food of course must make more mutton, beef, or pork, than what is innutritious; but here, as in every other branch of agriculture, general rules must be accommodated to circumstances. The degree of every particular style of treatment must be accommodated to the individual character of the animal and the general character of the breed to which it belongs. The most profitable management of a well-bred animal involves outlay of shelter, food, and attendance that would be thrown away upon a Kye.

We shall next month refer to the relative merits of cattle, sheep, and pigs, in the economy of the meat manufacture, on which we shall have to quote the results of experiments by Mr. Lawes. Under the section in each month devoted to the management of the live stock of the farm, further remarks on management in the feeding stall and yard will also be found.

III.—CROP CULTIVATION.

We referred last month to the seed-time of wheat, to the preparation of the seed for sowing, the selection of a sort, and the preparation of the land for the seed after the different crops which it ordinarily follows. ~~It is proper to add, that when~~ land is in good order and an early seed-time is chosen, one bushel per acre sown in rows a foot apart has proved enough. Under ordinary circumstances, ~~we would not sow~~ in any of the southern English counties

more than six pecks per acre in October. But it is never advisable to depart recklessly from the practice of the neighbourhood ; and it is well, therefore, to make cautious experiments in thinner seeding than ordinarily prevails wherever climate, game, lack of drainage, or infertility has induced the practice of sowing a larger quantity of seed. Experiments some years ago on Whitfield Farm, Gloucestershire, on a sandy loam in good heart, led to the conclusion that rows of wheat fifteen inches apart, at the rate of about five pecks an acre, produced a maximum crop. And when the land is well cultivated by horse and hand-hoe during the growth of the plant, it is well to have the rows nearly a foot wide.

Of the sorts known to English agriculture, we give a number of illustrations in the following pages. On their relative merits generally, the following remarks given in the *Bath and West of England Agricultural Journal* may be repeated here :—

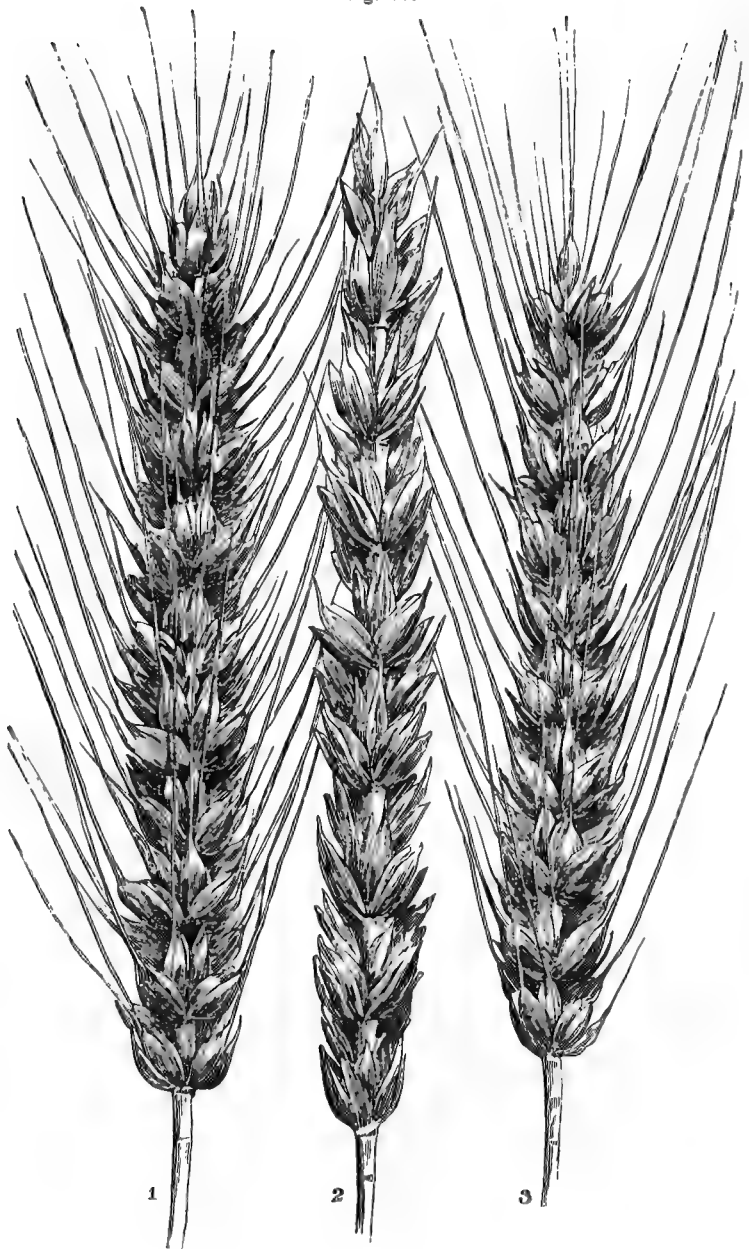
Of the relative hardiness of sorts, as of their relative productiveness, there is some difficulty in collating reports, arising out of the uncertainty of names ; but it appears to be generally believed that red wheats are hardier than white, and that the rough-chaffed and the red-chaffed white are among the hardest kinds of that colour. This they probably owe in some measure to the shortness of their straw, which hinders them from falling, where taller sorts would have been laid. This property they possess in common with the Fenton white, which is also highly spoken of. Mr. Blundell, of Bursledon, Southampton, reports thus of the ability of particular sorts of grain to cope with wet seasons :—

“It is generally admitted that the red varieties of wheat are much less liable to sprout in a season like the past than the white sorts ; but my experience, extending over a period of thirty-four years, enables me to say, that where the soil and climate is favourable, and the land in a good state of cultivation, the white wheats pay best, and during the above-named period have not sprouted in the harvest-field oftener than once in seven years ; and I hold this to be an important fact in the consideration of the subject, and I have thus never been deterred from sowing the best varieties of white wheat upon farms where the soil and climate were favourable. Again with regard to white oats, the earliest sorts have the advantage in a wet season, being fit for the sickle fourteen days sooner than the ordinary black kinds—a matter of immense importance, when we find that all wet seasons are productive of late harvests, and the advantages of early cutting whilst the days are longest are obvious ; and the same remark applies to the wheat crop to a certain extent, as most of the white sorts are the earliest to ripen.”

On this subject Mr. Horswell, of Tavistock, also says :—

“The red-chaff kind among the white wheats is the hardiest, but red wheats bear wet weather better than white ones ; any grain

Fig. 59.



Shirrell's Bearded Wheat.

Talavera.

Pringle's Bearded Wheat.

which when properly harvested weighs heaviest per bushel is the hardest of the kind. Two kinds of red wheat known in Devonshire by the names of 'Benjy and 'Nursery' are of this description." Perhaps among the lessons of recent agricultural experience, I ought to name the increased growth of the April bearded red wheat (*Triticum æstivum*), and the increased favour with which it is very generally regarded. Mr. Arkell, of Swindon, thus describes his experience of it:—

"I think my best crop of wheat this year will be the bearded April or Scotch wheat; planted the 1st day of March, it stood the wet season well, and ripened kindly. I have grown it for many years, and have found it do best in moderately wet seasons."

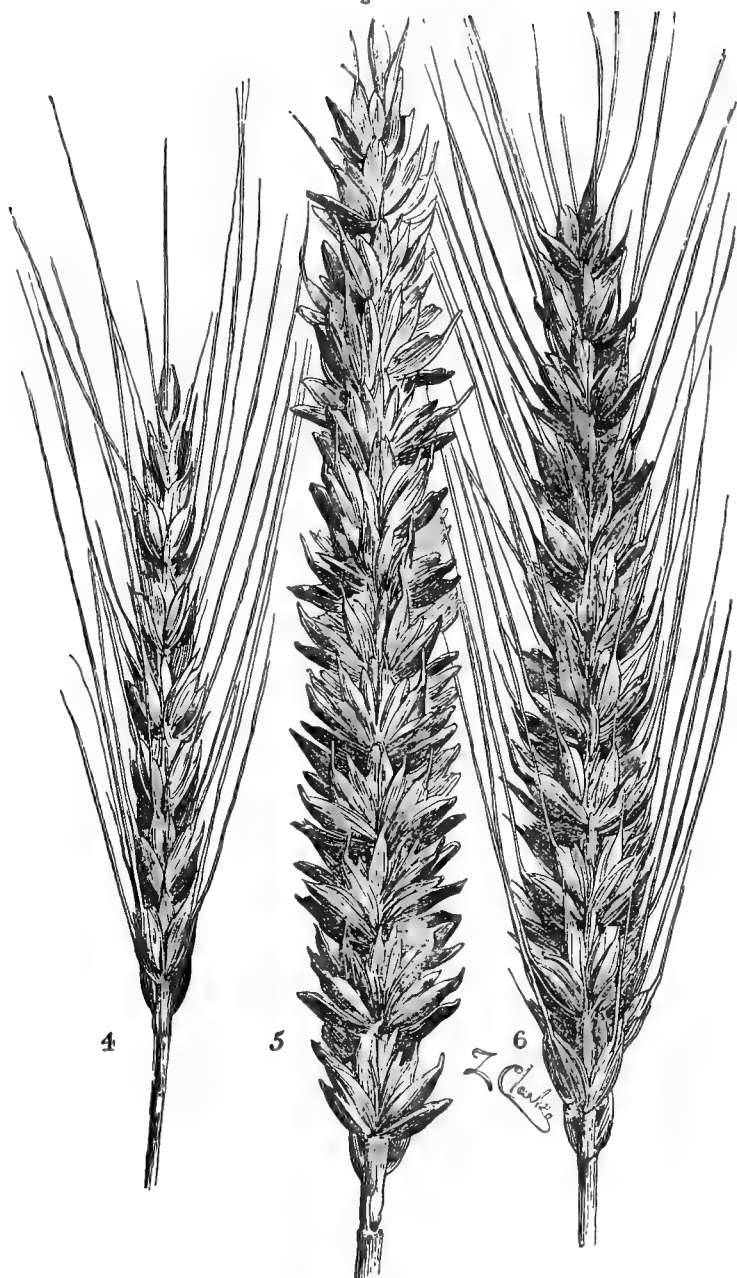
We now give a number of short descriptions of the sorts figured—for which let us here acknowledge our obligation to Messrs. Lawson, of Edinburgh, who kindly placed specimens at the disposal of Mr. Clarke, the artist by whom they have been drawn. Fig. (59), No. 1, is an ear of Mr. Patrick Shirreff's new bearded white wheat, for which he has received the Highland Society's medal. It is one of several new wheats, some of which are named farther on, for which we are indebted to Mr. Shirreff's patience in selection and perseverance in cultivation up from single ears, until a stock of sufficient quantity and of well-ascertained quality has been obtained. No. 1 resembles very much Pringle's white bearded wheat, represented at No. 3. It is difficult to distinguish the ears of the two sorts, but there is no difficulty in distinguishing their seeds. The grain of Shirreff's is short and rather small, white, transparent, and pearly looking. The grain of Pringle's is a little larger and longer than Shirreff's, shining and white with a rich creamy tinge. Both are new sorts of sufficiently well-ascertained merit to deserve representation here, but without a long-established character such as other sorts possess.

No. 2 is the Talavera white wheat, easily recognised by the distance between the sets of florets on the rachis of the ear. Col. le Couteur's Bellevue Talavera wheat is one of our best sorts for spring sowing. It is a white wheat of good quality, and sufficiently prolific. The straw, though short, is brittle; but it is stiff, and well adapted for cultivation on rich land.

No. 4, fig. (60), is another spring wheat, a bearded red wheat, commonly called April wheat, from the time up to which it may be sown. It is a very productive sort, of fair quality; and justice is not done to it in the specimen selected for representation. It is referred to above as coming into more general adoption. This is especially the case on the chalky land of some of the southern counties.

No. 5 is Hallett's Pedigree wheat, to which full reference has been already given at page 471.

Fig. 60.



No. 6 is Shirreff's Bearded red, another sort due to Mr. Patrick Shirreff, of Haddington, who selected it about five years ago, and thus describes it. "It is an autumn variety, ripening early, tillering freely, not apt to lodge, and characterized by a long beard. This appendage seems to have been attached to the chaff of the original wheat plant, as a great majority of the varieties over the globe are found to have beards. The strength and elasticity of the beard of this wheat prevents the wind shedding the grains at the apex of the ear, and by admitting air into the sheaf, the sprouting of the grains is checked in wet seasons, and the hardening of them promoted in fine weather. Under no circumstances is the beard found to be injurious, and in the fickle climate of Britain it is highly advantageous."

In the figure containing these three sorts, No. 4 suffers by its neighbourhood to the fine ears of Hallett's and Shirreff's wheats in Nos. 5 and 6. It is unquestionably inferior to either of them, for of Hallett's sort we have seen ears eight inches long, and containing 120 grains. The April wheat shown on this figure appears to us, however, of less vigorous growth, not so bold, nor of such breadth of ear as it generally exhibits.

No 7 is the common red Lammas wheat, the original of a great many other sorts, most of which are barely distinguishable from it. Mr. Lawson describes it as having been originally from France. It yields grain of good quality and fair productiveness, and is probably at this moment more largely cultivated as a red wheat than any other sort. Many sorts are hardly distinguishable from the red Lammas except by name and local reputation. And as resembling it we may here name the so-called Nursery wheat, a commonly cultivated sort of good quality.

No 8 is the white Essex wheat, of a white colour, transparent, and thin skinned; much approved by the miller; resembling many other kinds, as Uxbridge and Mungoswells (another of Mr. Shirreff's wheats) in the form of its ear; somewhat long in straw, and not so early in ripening as some other kinds. These characteristics are taken from Lawson's account of it.

No. 9 is the Spalding red wheat, a coarse productive sort, strong and stiff strawed, and the original of a number of well-known sorts, among which we name Browick red wheat as one of the best. These are all tall, stiff-strawed wheats, well adapted to the rich, fenny districts where they originated, of vigorous growth and productive. Spalding wheat is said by Mr. Haxton to have often yielded eight quarters per acre in Fifeshire.

No. 10, Chiddam white wheat, though represented in the drawing as almost equal in length and strength to the ear of Spalding, is rarely so long and fine. It is remarkable for the quality of its grain, which is white and starchy, round and heavy. It is well

adapted to the lighter class of soils in the southern English counties, and is much cultivated on the chalk lands of Surrey.

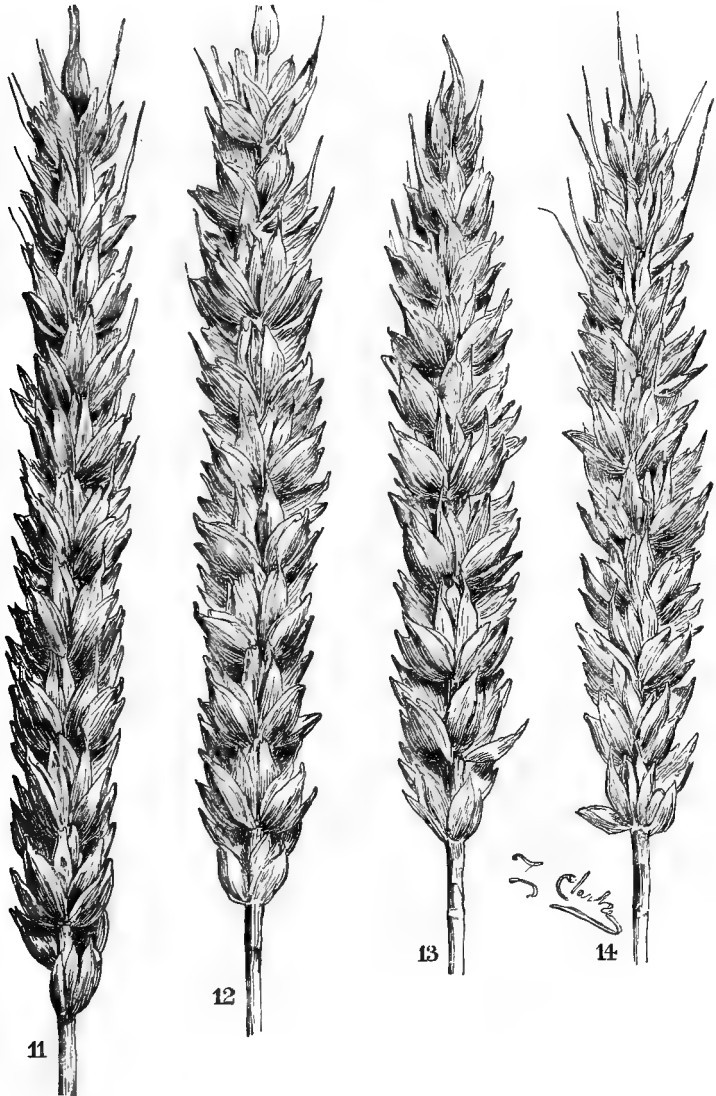
Fig. 61.



The Mungoswells wheat, No. 11, is another of Mr. Shirreff's sorts, resembling Hunter's in sample, but said to be somewhat

earlier and to tuer more freely ; but apparently not possessed of that fixity of character which has given Hunter's its reputation.

Fig. 62.



Mungoswells.

Hunter's.

Hopetoun.

Fenton.

No. 12 is Hunter's, one of our oldest standard white wheats, largely

grown in Scotland, where it has been known for sixty or seventy years. In some of the earliest and most extensive comparisons of wheats, Hunter's came out in quality and quantity together, with more per acre than any other kind, and while many of its rivals have possessed but a short-lived reputation, it retains the character with which it started. The following description of it is by Mr. Hope, of Fenton Barns:—

“It is a white wheat, though in some seasons many of the grains are very high coloured, clear, and flinty, which might make those unacquainted with it imagine it was mixed with red. The straw is of moderate length, the ear medium-sized, the chaff smooth and thin, but with a short sharp awn, and the pickles are neither too closely nor too widely set. It possesses a hardy constitution, withstands well the winter's frosts, tillers freely in spring, and is as little liable to disease as any variety I am acquainted with. For more than a dozen of years it formed the standard by which I tried all other varieties, and it still continues unquestionably the favourite wheat with the great majority of farmers in the Lothians. I have tried against Hunter's various English wheats, such as Taunton Dean, Tall Cluster and Dwarf Cluster, Kent white, and other varieties without any distinctive name; but though they sometimes grew of much finer quality the first year after they were imported, they rarely yielded so much grain, and always rapidly deteriorated. The Chiddam and Pearl wheats, though fine in quality, never yielded within a quarter per acre as compared with Hunter's.”

No. 13 is Hopetoun wheat, a variety originated by Mr. Shirreff, of Haddington. It possesses a stiff, tall straw, a long ear, and is a productive sort, of good quality, perhaps not quite so hardy as some other kinds. It is a smooth-chaffed white wheat, and has a magnificent appearance when growing, and consequently sometimes disappoints sanguine growers. It has been extensively sown both in Scotland and England, and does not appear to be losing favour.

No. 14 is an ear of Fenton white wheat.

About eleven years ago a plant of wheat bearing three ears on a remarkably stiff and short straw was pulled by Mr. George Hope, of Fenton Barns, E. Lothian, out of a quarry in his farm, on the *débris* of which it had accidentally grown. The grains which these ears contained on being sown for a few successive years produced enough to seed a field; and as the wheat retained during that time the characters which distinguished it at first, Mr. Hope sent it into the market as a new variety, and the Fenton white wheat accordingly is now known in every part of the country. It is characterized by a moderately large ear of even shape, on a straw not only remarkably short, but remarkably various in length. The consequence of this latter peculiarity is that its yield of grain generally

exceeds the expectation formed of it by those who see it before harvest for the first time. Its performance has always exceeded its promise during the years that I have known it. This abundant yield is no doubt the result of the distribution of the ears through various heights above the land; there is not that crowding of them which there would be if they stood all on one level. And this one sort accordingly exhibits in itself a result which can be obtained in other cases only by mixing two or three sorts together which grow straw of various lengths. This illustrates the result of experiments in France and elsewhere on the productiveness of different grains as compared with that of a mixture of them all.

There can be no doubt that the productiveness of a crop is due, among other things, to the use it can make of air and sunshine; and many sorts of wheat, the ears of which when mixed shall grow at different levels above the land will, just as Fenton wheat is found to do, yield all the more abundantly from this one cause. And the practice which seems to be increasing, of using mixed wheats for seed, may receive its justification in this way.

The Fenton wheat has been described by Mr. Hope, who says:—

“I think the heads of the Fenton wheat are larger than the Hunter’s, and that it comes into ear a few days earlier; the grains, also, are rather more closely set; the straw is much firmer and shorter, and with the peculiarity of being different lengths from the same stem, which causes the sheaf to be a mass of heads, from the band upwards. It should be cut when the grains are soft, otherwise the appearance of the sample is impaired; but when cut green it has the clear and flinty look characteristic of Hunter’s, so that it is scarcely possible to tell the one sample from the other. I confess, the quality is more easily affected by the weather than some other kinds, as, when stacked damp, the grain gets dull and dingy. It is, however, by far the most prolific white wheat that I ever tried, whether sown in autumn or spring. It is far from being a great crop in appearance; judging it when growing, or even after it is cut, you are apt to think little of it, and it is rarely that you feel satisfied, or that its superiority is manifested until it is put into the sacks. The weight of straw per acre is frequently as great as that of crops a foot taller. I have found from several experiments that the weight of the straw averages about one-fourth more than the weight of the grain, which is just about the ordinary proportion of other kinds of wheat. What I esteem its chief qualification, is its strength of straw; if it is lodged, most other kinds would be useless. It is, therefore, well adapted for high farming, which is happily now the order of the day, most farmers having discovered, that if manure is dear, land is still dearer, with its accompanying expenses. Six years ago, I sowed a twenty-four acre field, one half Hunter’s wheat, and the other half Fenton, the difference in favour

Fig. 63.



Rivet.

Egyptian.

Velvet-eared.

of Fenton was fully two quarters an acre, from Hunter's being completely laid; since then, I have entirely confined myself to the growing of Fenton, except an occasional acre or two of any new well-recommended variety."

Besides the kinds thus named, we have among red wheats Hickling's Prolific, Golden drop, Kentish high back—the two last resembling the Nursery wheat, and the Blood-red wheat—a long and stout-strawed, large-eared kind. Piper's thick-set wheat is another red sort, easily recognised by its very short straw and close-set stout ear. Clover's red is of vigorous growth, straw long but thick, so that it is not likely to fall. It is a Cambridgeshire wheat, and is there being preferred to the Burwell red, a variety of the Golden drop class.

Among white wheats, again, the Velvet-eared, a short-strawed sort, is of remarkable quality and productiveness, and very extensively grown (Fig. 63, No. 17). Morton's red straw wheat too, best of a great number compared by Mr. John Morton, of Whitfield Farm, Gloucestershire, long cultivated there, and extensively grown elsewhere, of large and heavy grain of good quality, and characterized especially by a red-coloured staw which becomes yellow on being dead ripe. The "Eclipse," a very long-eared sort, was another kind marked out as good by Mr. Morton's experiments, which were reported in the first volume of the *English Agricultural Society's Journal*.

In fig. 63 we have, besides No. 17, the Velvet-eared white wheat, one of our best sorts as regards quality of grain, two bearded wheats of a coarser description of grain. The Cone or Rivet wheat (No. 15—not a very characteristic ear) is a very productive, but coarse sort. The ears hang as they become ripe and lose their awns. It is later than other kinds and not extensively grown. It is, however, often chosen by allotment cultivators and cottagers, to whom a large brown loaf is of more consequence than a smaller white one.

No 16, Egyptian wheat, though strongly recommended by some writers as a productive sort, does not gain way in ordinary agriculture. The appearance of its ears would lead one to believe its productiveness per acre.

On the fixity of characters possessed by these varieties of wheat, we quote the following remarks from Mr. Shirreff, whose name has been already often referred to. He speaks thus of the failures of attempts to alter the character of varieties:—

"In illustrating this it may be mentioned that a few seeds of the Fern or April wheat, which is a summer variety, and a few seeds of two of my new bearded autumnal varieties, were put into the ground on March 15th, April 15th, and May 15th. The March seeding put forth ears and ripened in the usual way. In the case of seeding in April the summer variety eared well, while only two puny ears came forth from the autumn wheats, the remainder being a tuft of leaves.

With the May seeding the summer wheat eared with rapidity, while the autumn varieties contained a cluster of grass and did not ear until the following season. The non-earing of autumn varieties when sown late in spring may be held to be the chief distinction between spring and autumn wheats, and I have witnessed the non-earing alluded to in different parts of the world, and witnessed the loss of crops by the one kind of wheat having been sown instead of the other. These two wheats are so distinct in their natures that I believe human power cannot impart the earing habit to an autumn variety, and *vice versâ*. But while advocating the stability of the varieties of the wheat plant, I have lately had satisfactory evidence of more than two kinds arising from the seeds of one ear. Such a result is to me both new and unexpected; and while announcing the fact no remark shall be hazarded without further experience. New varieties do most certainly arise from time to time, and are known as sports which have baffled investigation. The appearing of a new kind does not, however, materially affect the question of the stability of well-defined varieties, because both the old and new remain distinct, and it is only the addition of another sort without the old one being altered.

The ear of the wheat plant is presented in endless colours, textures, and forms. The chaff is the cradle and the clothing of the grain. The red and white, the thick and the thin, the rough and the smooth, and the bearded and the bald chaffs may all have admirers. But this diversity forms no guide whatever to the quantity and quality of the seeds. The notches on the ear also differ materially, and there is a popular and perhaps mistaken dislike to the notches being far apart. Viewing the process of evaporation, the lodging of the crop, and the beating or threshing of it by wind, a cross-set or club-shaped ear is manifestly disadvantageous. Provided the ear has a sufficient number of notches, perhaps the wider they are apart the better.

The beard or awn which characterizes some varieties of wheat has also been the subject of popular and mistaken dislike, which doubtless arose from the Rivet wheats having long been the only cultivated varieties with beards. But the Rivets are peculiar, having pith in the straw, a pendulous ear, and flour so coarse as to be chiefly used for dusting purposes. The beards also often disappear on the crop reaching maturity, in consequence of the pendulous ear swinging and rubbing on the elastic stalk. With other wheats the case is different; the ears being upright and the beards projecting at an angle, form a strong spring, which is a considerable protection against wind, and is also the means of admitting air into the sheaf. In several places during the present season the effect of the beard lessening injury by wind was witnessed, and last year its drying property by admitting air made a difference of 9s. a quarter on the

first day of new wheat being exposed in the market of this place. While I am aware that the chaff and beards have no relation to the grain, it may be mentioned as a singular coincidence that on examining the grain of the present crop of a collection numbering about 150 kinds of British wheat, excluding Rivets and curiosities, in every class the bearded varieties were found to have the finest quality of grain."

We add to these notices of varieties remarks on the cultivation of the crop as carried on in the Lothians, and described by Mr. Hope, of Fenton Barns, and others, before the Highland Society. Mr. Hope said:—

"With regard to the proper quantity of seed to sow, this depends so much on the quality and condition of the land, even on the size of the grains and the manner of depositing the seed, and above all, on the period at which it is sown, that it is in my humble opinion nothing less than absurd to attempt to fix any general rule. I may state, however, my own practice. When the land is fine and dry I drill from 8 to 9 pecks the Scotch acre ($1\frac{1}{4}$ imperial) up to about the 20th of this month; after that I increase it to 10 pecks, and if sown in December to about 11. In spring I sow as nearly as possible 12 pecks or three bushels per Scotch acre. I drill the greater part of my grain. Last year I had about 250 Scotch acres in grain crop, of which 40 acres were sown with the machine broadcast, and upwards of 200 acres were drilled. I drill on purpose to get rid of annuals, and also to check that pest of my neighbourhood, wild oats. Hitherto I have usually hand-hoed the whole of it, and I have often seen in spring when part only of a field was hoed, that in a few days it assumed a darker and more growing appearance than the piece that was still to do; and once when the field was rather long in being finished, the earliest hoed maintained its superiority till the last. I have known that is said, a turn of the harrows will have the same effect on broadcast wheat. I have even seen very thin wheat beneficially harrowed, in order to make it thrive, but this merely shows the benefit of stirring the surface. And surely the hoe can be applied with greater precision and effect to a drilled crop, than a pair of harrows to one sown broadcast. I do not think that it matters much to the yield of the crop, whether you drill or sow broadcast, unless you also hoe, and I have no doubt but that sometimes when there is an abundance of plants a turn of the harrows might be equally beneficial to both. I do not count much on the saving of seed by drilling, as the broadcast sowing-machine now in universal use deposits the seed as evenly and correctly as the best drills. It has been supposed, from wheat being the most valuable of our cultivated grains, that therefore it is the most exhausting to the land. So far as my experience goes, I am inclined to think this supposition erroneous—wheat is much longer on the ground, and conse-

quently must draw more of its support from the atmosphere than the other crops—at all events, I find that I have always better crops after wheat than after barley; and why 8 or 10 quarters of oats should not exhaust an acre of land more than 4 or 5 quarters of wheat, I cannot understand. If I am correct, you must see the absurdity of clauses in leases restricting the number of acres that shall be under wheat. It is essentially a condition that the landlord imposes upon himself to receive less rent than he might otherwise do.”

Lois-Weedon Culture.—It is not right to finish our remarks on wheat culture without referring to the Rev. S. Smith’s method of wheat growing—that modification of Tull’s system to which the name of Lois-Weedon has been given.

Since 1845, when the position of the British agriculturist seemed almost desperate, the clergyman of this parish has annually urged upon farmers the possibility of growing wheat more constantly and therefore more abundantly and more profitably on all “wheat lands,” by a more thorough tillage of the soil and subsoil during its growth than under ordinary circumstances it receives. This he did at the first as a public-spirited contribution to the necessities of the times, and this he has continued to do, notwithstanding the annoyance of publicity, urged by an annually increasing conviction of the soundness of his doctrine and his practice, and an increasing confidence in the fitness of both to the circumstances of the ordinary wheat-growing soils of the country.

It is a marvellous thing that, notwithstanding the extraordinary productiveness of his land under “Lois-Weedon” management, so few attempts have been made to realize his experience elsewhere.

Consider what the facts are. Here is a field which, in 1843, was in grass no better than the rest of the parish now let at about 30s. an acre; that turf was pared one or two inches deep and carried bodily away; the soil was then ploughed five inches deep and sown with oats succeeded by vetches, both crops being carried wholly away; the field was then set out and sown with wheat in triple rows one foot apart, with three-foot intervals cultivated during the growth of the crop as the seed-bed of next year’s triple rows of wheat, *their* three-foot intervals being the cultivated stubble of this year’s crop. And so, annually, since that time, has a crop of wheat been grown without manure, and been carried wholly from the land without return. The land has been bearing under this robbery, beginning with 1847 up till 1857, thirty-four bushels of grain per acre; in 1857 it bore thirty-six; in 1858 it bore more than forty; in 1859 it bore two bushels and five quarters of good wheat per acre. And a practical farmer who had just visited the field (1860), after seventeen years of treatment such as this, said, “There is no better wheat oil in the country.”

The principle involved in the success of Mr. Smith's process at Lois-Weedon ought to exert, and does exert, great influence on agriculture generally, and on wheat-growing in particular, even where his methods are not exactly followed.

On the depth of soil and the quantity of internal superficies it thus presents depends its wealth as a store-room, both of atmospheric food and of properly digested mineral food. On the quantity of sunshine and of freely-moving air among the leaves of plants depends their ability to draw food thence. Now what does Mr. Smith exhibit to the agriculturist at Lois-Weedon but an illustration of the way in which both of these principles, on which all agriculture hinges, receive extraordinary development, and so produce extraordinary fruit? He cultivates deeply the soil close by the growing plant, and on this deeply-cultivated soil he sows the next year's crop. And the spaces which he thus leaves blank for cultivation are, at the same time, so many gaugways for the thoroughfare of air and sunshine amongst the stems and leaves of his growing crop.

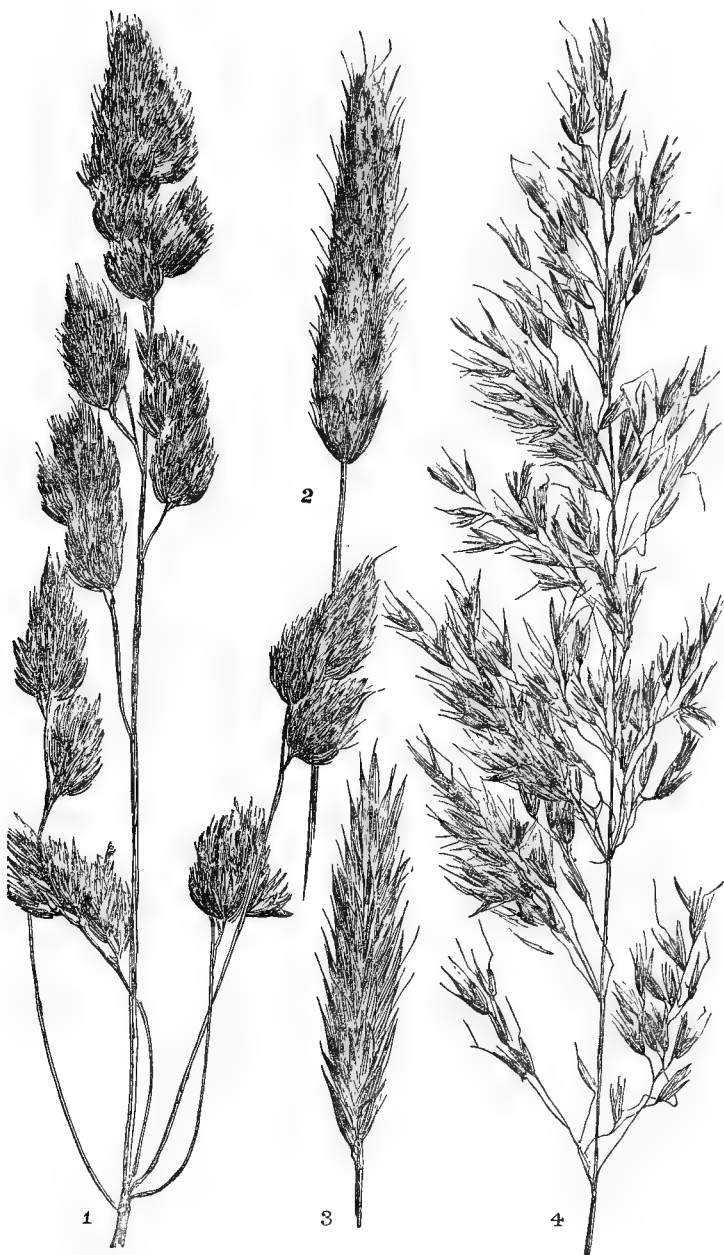
That Mr. Smith does not attempt impossibilities is shown by the results which he has obtained; and that he does not *teach* impossibilities is known to every reader of his books. The soil must contain the mineral food of the plant; if it be not in that sense a wheat soil, it will not grow wheat either on the Lois-Weedon or on any other plan. This is what he says:—"I suppose at the outset the land intended for wheat to be wheat land, that is, loamy or clay land, containing naturally the mineral substances necessary for the growth of wheat. Land which does not contain these substances must be supplied from without. I grow wheat on both descriptions of land; and to my light gravelly soil, instead of the special manure I recommend to others I apply what is tantamount, dressings of clay. My heavy clay land is furnished already. For I apprehend I am fully justified in my belief that all clays of fair quality contain within an accessible depth a store of mineral food for the wheat plant, varying, indeed, in amount and composition according to the nature of the rock from which they were disintegrated and derived, but still in such abundance as to take centuries of cropping to exhaust it. I do not mean that the time it will last is infinite, but merely so distant as to be indefinite when the supply will cease."

I shall not quote at any greater length, but will recommend agriculturists to read the books on Lois-Weedon cultivation,* and to satisfy themselves, as they may easily do, both of the reasonableness of the explanation which has been offered of it, and of the accuracy of the account which has been given of it.

It only remains for me to say regarding the wheat on the undunged deeply-cultivated clay soil at Lois-Weedon, that when I last

* "A Word in Season to the Farmer; or, How to Grow Wheat with Profit" Seventeenth Edition. Ridgway, 169, Piccadilly.

Fig. 64.



(1) Cocksfoot. (2) Foxtail. (3) Sweet-scented. (4) Oatgrass.

saw it (July, 1860), it was a healthy, vigorous, upstanding crop, promising a full return, which, according to the past three or four years, might be expected to be from thirty-six to forty bushels an acre. Compared with a neighbouring field of wheat it was of a much more uniform character; there were fewer undersized ears and dwindled stems. The outer rows of the triple sets were perhaps a shade better than the inner, indicating the value of the agencies on which Lois-Weedon success depends; but the whole plant was vigorous, and looking at what was growing on it, might well be pronounced first-rate, notwithstanding its seventeen years' ignorance of the dung-cart.

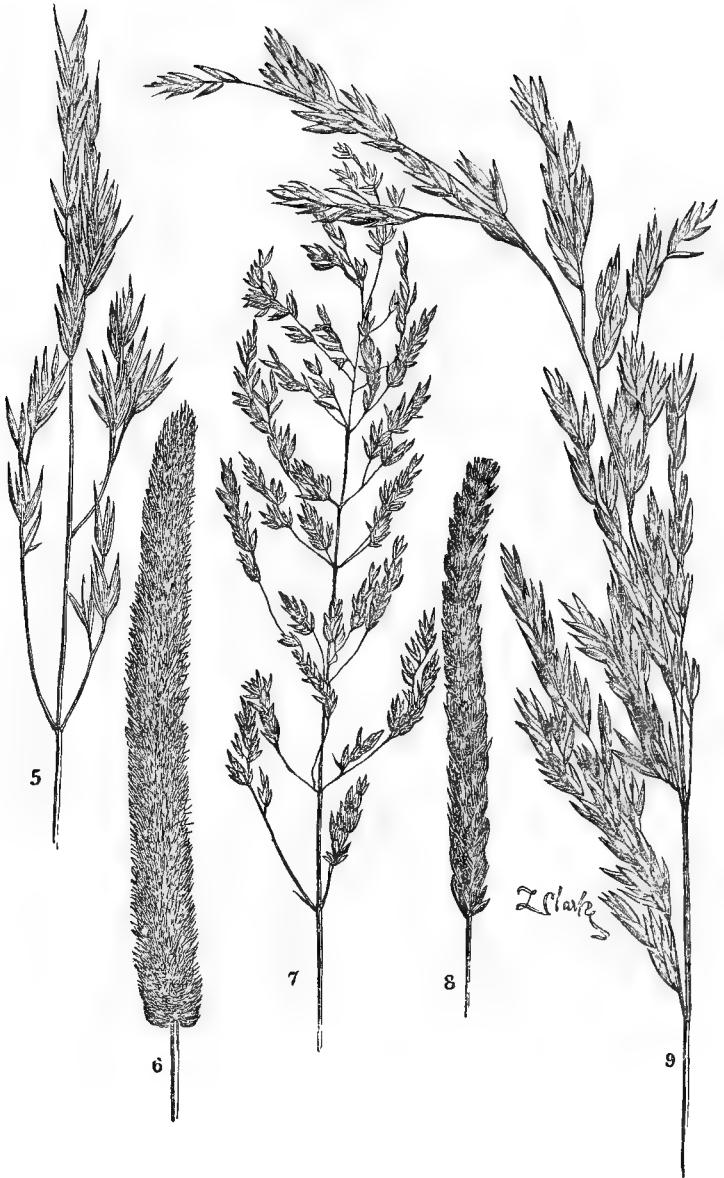
Grasses.—The subject of sowing grasses and laying down land to permanent pasture has been already discussed. The usual times of sowing are in early spring, or in an early autumn month. September is as good a time of the year as any, and this subject was named then. It only remains for us to give drawings of the kinds most commonly used as mixture.

In Fig. 64, No. 1 is a sketch of *Dactylis glomerata*, cocksfoot grass, described at page 202 as one of the most useful of our common grasses. No. 2, *Alopecurus pratensis*, or foxtail grass (p. 201), is another bulky, succulent, and nutritious grass, introduced generally into mixtures for sowing in all rich soils. No. 3, *Anthoxanthum odoratum*, the sweet-scented vernal grass (p. 202), is one of our earliest and most common grasses; not in itself very nutritious, but useful for the pleasant smell it gives to hay. No. 4, *Arrhenatherum avenaceum*, tall oat grass, is of very little service in mixtures for laying down land to permanent pasture. Its natural habitat is on dry, rough hill-side soils. It is not a very nutritious grass, nor is it very palatable.

In Fig. 65, No. 5, is a species of one of the most valuable of British grasses. *Festuca rubra* (p. 203) is a short sandy-soil grass, adapted for sheep pasture. No. 6, *Phleum pratense*, catstail grass (p. 204), is a productive and nutritious grass, found on all first-class clay land pastures. No. 7, *Poa trivialis* (p. 204), rough-stalked meadow grass, is adapted for moist pastures. No. 8, *Cynosurus cristatus* (p. 202), is a short grass, very commonly met with, but of no great value as food. No. 9, *Festuca elatior*, one of the larger fescue grasses (p. 203) found in all coarse dry land pastures; a palatable food for cattle and horses, and yielded abundantly.

In Fig. 66, No. 10, is *Agrostis alba* (p. 201), one of the grasses growing on dry sandy soils; of no value, except perhaps for sowing a rabbit warren, or on light sands which will yield no useful pasture. No. 11, *Festuca duriuscula*, hard fescue (p. 203), generally sown in mixtures for good pastures—early, sweet, and nutritious. No. 12, is *Festuca loliacca*, darnel-leaved fescue; a very nutritious and excellent species of the same genus. No. 13, *Lolium Italicum*,

Fig. 65.



(5) Red Fescue. (6) Catstail
(8) Crested Dogstail.

(7) Rough-stalked meadow grass.
(9) Tall Fescue.

Fig. 66.



(10) Marsh Bent.

(11) Hard fescue.

(12) Darnel-leaved fescue.

(13) Italian rye-grass.

Italian rye-grass, has been already fully described in these pages. It is distinguished from the common perennial rye-grass by its armed spikelets and more vigorous growth. (See Index.)

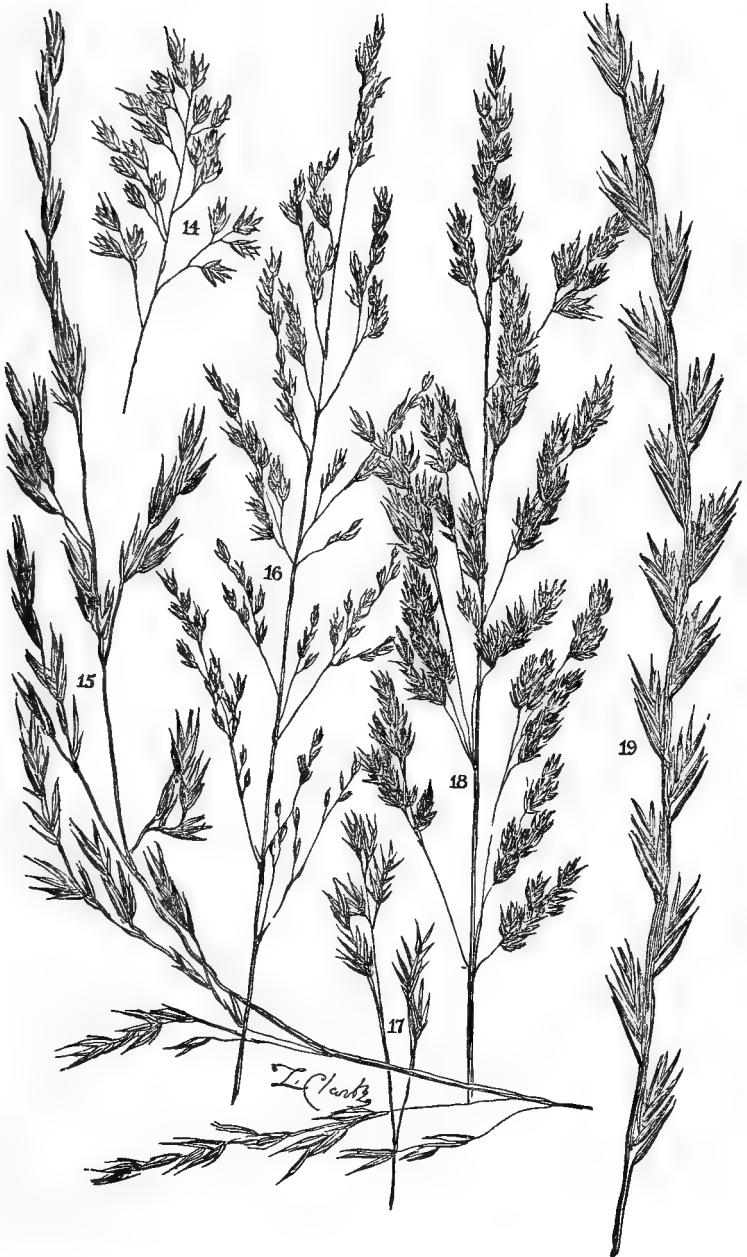
In Fig. 67, No. 14, is *Poa Alpina*, or broad-leaved mountain poa. It has latterly been recommended for upland pastures, as yielding a good and sweet pasturage. No. 15, *Festuca pratensis*, meadow fescue (p. 202), is probably, on the whole, the most useful of all our British grasses, and finds a place in all good pastures, and in all mixtures for laying them down. No. 16 is *Poa nemoralis semper-virens* (p. 204), wood meadow-grass, is adapted for shady places, orchards, and the like. No. 17, *Festuca ovina*, sheep fescue (p. 203), a sandy-soil grass; short, but useful in sheep pastures. No. 18, *Poa pratensis* (p. 204), smooth-stalked meadow-grass, is found in almost all good dry pastures, and is generally added to mixtures for laying down grass-land, though it does not rank with the most nutritious and productive of British grasses. No. 19, *Lolium perenne*, perennial rye-grass (p. 203), is one of our best meadow-grasses. A great many varieties exist, which are sold under different names, and possess very different properties, both as to their perennial character and as to the bulk and nutritiveness of their produce. *Lolium perenne* finds a place in all mixtures for laying down land to permanent pasture.

The proportions in which the grasses thus named are mixed for use as seed under different circumstances of soil, &c., are given at p. 207; and the method of sowing and subsequent management of the land are described at p. 205, 207, &c.

Mangold Wurzel.—The end of October is the proper time in which to harvest this crop. If left till later there is great risk of its being destroyed by frost. This was, in fact, the fate of a large portion of the crop in 1859, owing to its having been left in the field during two or three days of severe weather in the latter end of this month. The leaves were stricken by the first night's frost; and as the severity of the weather lasted over several days, the bulbs were soon frozen through, and they rotted soon after thaw. We had a lesson then on the need of early harvesting the crop, and protecting it for use in spring.

In illustration of the method of harvesting this and other root crops, I will describe the plan adopted on Whitfield Farm, near Berkeley, Gloucestershire, where it has been the custom to grow about forty or fifty acres annually of swedes and mangold wurzel. Less than one-half of this has been swedes, twenty acres or more mangold wurzels, and ten acres, or thereabouts, of Belgian carrots. The whole of these crops were pulled and carted home for consumption in stables, yards, and cattle boxes during winter. It was the custom to let the whole work to five or six men, who undertook to pull and top and fill the bulbs into carts for about 7s. per acre

Fig. 67.



(14) Mountain pos.
(17) Sheep fescue.

(15) Meadow fescue.
(18) Smooth-stalked.

(16) Wood meadow grass.
(19) Perennial rye-grass.

for swedes, 8s. or 9s. for mangold wurzels, and 20s. for carrots. The last-named crop needed to be half dug when being pulled, but with reference to the others, which were grown in rows about twenty-six inches apart, five men would undertake the pulling, each man taking two rows, and placing the roots pulled, so that the whole eight rows lay together; eight or ten boys and women topped and tailed the roots as they lay upon the ground, cutting the head an inch or so from the crown of the root, so that the leaves fall separate; and eight or nine boys and women, with a man, filled the carts as they came up. Three carts were sufficient to keep a continual succession ready to be filled, when the distance to the store did not exceed 800 or 1000 yards; and the work was accomplished at the rate of about five acres of the turnips daily.

The pulling is easily done in the case of a good crop. The larger the roots the easier it is to pull them out of the ground. It is in the case of stunted, ill-grown roots, with fangs and forked growth, that any difficulty arises. To meet a case of this kind, it may in some cases be advisable to undercut plants as they stand in the rows, by a horse-drawn tool fashioned for the purpose; but this is more frequently needed for the turnip crop, and will be named hereafter.

The following is an actual record of one year's experience on Whitfield Farm when some forty acres of each work had to be done. It includes an account of the hands employed by the contractors in lifting forty acres of mangolds and swedes, and the time they took to do the work, and the tons of roots placed in the store.

18—	Nature of the crops, and No. of the Field.	Men pulling.	Women and boys cutting roots.	Filling the carts,		Acres.
				Men.	Women and boys.	
Oct.	Taking up Mangold					
17	No. 6 field	5	10	1	9	} 10
18	No. 6 „	5	10	1	9	
19	No. 10 „	5	10	1	9	} 11
21	No. 10 „	5	10	1	9	
22	No. 2 „	5	10	1	9	} 5
23	No. 2 „	} 5	10	1	9	
	Swedes—No. 22 „					
24	No. 24 „	5	10	1	9	} 14
		40	70	7	63	

	£	s.	d.
The contract was for 29 acres of mangold at 6s. 6d. per acre .	9	8	6
Ditto, ditto, 11 acres of swedes at 5s. 6d.	3	0	6
Total	£12	9	0

The wages earned by the contractors, and paid by them to the hands they employed.

	£	s.	d.
47 days of a man at 2s. a day	4	14	0
70 days of a woman at 10d. per day	2	18	4
63 days of boys and girls at 9d. per day	2	7	3
Total	£9	19	7

Leaving 2l. 9s. 5d. to be divided amongst the contractors more than their daily wages of 2s.

Horse work in hauling the roots to the store.

No. 6,	3 days of 3 horses = 9 days,	306 tons from 11 acres.
„ 20,	1½ day of 5 „ 7½ „	242 „ „ 10 „
„ 2,	1½ day of 5 „ 7½ „	190 „ „ 8 „
„ 22 and 24,	2 days of 6 „ 12 „	192 „ „ 11 „
	36	930
		40

930 loads or tons carted by 36 days of 1 horse is 26 loads per horse per day.

The expense of carting 930 tons off 40 acres of mangolds and swedes.

	£	s.	d.
36 days of a horse and cart, at 3s. per day	5	8	0
7 days of a man to back and tip the carts in the stores at 2s.	0	14	0
17½ days of a boy leading carts at 8d.	0	11	8

Or at the rate of 3s. 4d. per acre £6 13 8

The expense of storing the loads and thatching them.

	£	s.	d.
3 men 7 days, 21 days of a man, at 2s. per day	2	2	0
2 boys and 2 women, 7 days each, 28 days, at 10d.	1	3	4

Or 1s. 7½d. per acre £3 5 4

So that the total expense of harvesting the root crop of 40 acres was for pulling, &c., 12l. 9s., or 6s. 3d. per acre. For carting 930 tons home, 6l. 13s. 8d., or 3s. 4d. per acre. For storing them, 3l. 5s. 4d., or 1s. 7½d. per acre.

The expense of harvesting 40 acres of roots, 22l. 8s., or 11s. 2½d. per acre.

In this case the crop was taken to a plot of land close by the farm buildings, and there piled up in heaps made in the following manner:—Two rows of hurdles are placed upon a firm piece of ground, parallel to one another, and nine feet apart. The interval between these is filled with roots, the carts bringing them from the field being backed between them, and tilted up at the proper place. The roots are piled up above the hurdles in a ridged or roof-like form, and are afterwards covered with straw, roughly drawn out as a thatch, which is kept in its place by the weight of long poles resting upon it. At intervals of two or three yards faggots are placed in the centre of the heap, inclining backwards, and reaching from the ground to the roof. These act somewhat as chimneys, and facilitate a due ventilation of the heaps, thus hindering any tendency to heating or putrefaction in the roots.

When one heap is completed, another is built within a foot of it,

the passage left being intended as a channel both for the egress of the water which drops from the thatch, and for the circulation of air. No security against frost, at the sides of contiguous heaps, is required, further than that which is afforded by the interlocking of the bushy eaves of their respective roofs. When, however, a series of heaps has thus accumulated, a rough dead-wood hedge should be constructed around them, and the space between it and the hurdles, which may be twelve or eighteen inches, should be loosely filled with straw.

I have annually kept many hundred tons of swedes, carrots, and mangold wurzels in this way, without losing any considerable portion by putrefaction. It fulfils the three conditions of success in the preservation of root crops through the winter—it furnishes security from the frost and wet, and at the same time provides a sufficient ventilation of the heaps.

A dozen such rows of roots, each three yards or more wide, and on an average four feet high, and perhaps 30 yards long, would hold 1000 tons. It is the work of piling up the roots as the carts bring them in, setting hurdles for them as the work proceeds, and thatching over, that is specified in the above tables as costing 1s. 7½*d.* per acre.

This was a systematic wholesale piece of work, and was thus conducted cheaply. To place in safety a valuable crop of roots, at a cost of less than 6*d.* a ton, is a very cheap and profitable thing; and no doubt where there is a large stock to keep on through spring and summer, the practice of storing roots will extend.

If the heaps be not hurdled round, they can be easily placed in safety by covering with earth. Let a headland be ploughed out—let the middle of it, for about six or eight feet wide, have all the earth thus moved thrown on either side—then pile up the roots on the floor thus prepared, and cover the heap ten inches deep with earth. In this case, however, whether for swedes or mangold wurzel, it is well to leave the heap for a week uncovered, except by leaves or straw, to allow all fermentation to cease, and the roots to partly dry, or they will be liable to heat and rot.

It is perhaps well to bear in mind that the experience of 1859 proved mangold wurzel capable of preservation even after being frozen, and capable of wholesome use as food even though partly rotted by the frost. It is well to avoid all risk by timely harvest-work; but it is not wise, if frost should have attacked the crop before it has been harvested, to abandon it. The following proof of this was adduced, along with many others, in a paper recently contributed to the *Bath and West of England Agricultural Society's Journal*. Mr Chadwin, of Tollard Royal, Salisbury, speaking of a heavy crop of mangolds caught by the severe frosts of October, 1859, says:—"I tried several of the roots, and they were perfect masses of ice. I knew it

would be useless trying to store them then, and therefore allowed them to remain a fortnight or three weeks after the frost had gone before taking them up. On finding that the frost had thoroughly left them, I put on all the strength I could, and stored them in the field, in long heaps, 7 feet wide at the base, tapering to the top, covering them with short straw or litter, and throwing over this 7 to 8 inches of soil, leaving it quite rough, without patting it down, and leaving the top of the heap without soil for ventilation. The heaps were never opened all the winter. When they were opened in May, the roots were found to be in a most perfect state of soundness, and I believe they might have been kept so till the following year."

On the value of frosted mangolds as food, the following testimony seems conclusive. Mr. E. Bowly, of Siddington, near Cirencester, says of the same year:—"The mangolds of 1859 were seriously injured by the very severe frost in October, when few had even commenced getting them up. This I think they very much recovered, and those who had the courage to store them in the ordinary way reaped the advantage they always possess for spring feed; but many, like myself, were fearful of permanently securing them. We got them together and covered them with straw, intending to look them over again and throw out any that appeared injured by the frost; but straw will not effectually keep out frost, and the very severe weather which followed again injured them most severely; we were therefore obliged to consume them immediately, instead of, as usual, reserving them for spring feed. I gave them to every description of stock, and without any apparent injury; indeed, the sheep and cattle did well on them, although many, indeed most of them, were in a soft state."

It is well, unless the land be wet and a great deal of earth cling to the roots, to do nothing to cleaning them, but to throw them into the carts as they are pulled, excepting only that the leaves are first cut off. This is done by a single chop of the knife, and at such a distance from the head that the leaves shall fall separate. It is best, too, not to cut the tap-root off, but to leave the root entirely untouched by the knife.

Mangold Roots for Seeds.—My experience on this subject has been confined to a small extent annually grown for the provision of seed for the home farm and for immediate neighbours. The plan adopted was to direct the man in charge of the party engaged in filling the carts to throw aside any roots of fair size and good shape—*i.e.* provided with a single tap-root, and a fine (not coarse) head and neck, while between the two there was a bulb from eight to ten lbs. in weight of the characteristic shape. This was, if tankard, straight, cylindrical, and uniform; and if globe, as nearly spherical as might be. The advantages of the latter shape are told on page 227.

These roots had had their leaves cut off like the rest of the crop, but only such roots were chosen as had had this done without touching the crown of the root. They were afterwards collected, and carried to the corner of the field, or the plot where seed was to be grown. They were planted by the spade, holes being dug in rows about a yard apart, and at intervals of thirty inches in those rows. The whole of the root was buried, the top being an inch or two below the surface. It will on rare occasions happen that a winter's frost will under these circumstances destroy the bulb, but in my experience, as a general rule not one in twenty of the roots thus planted have rotted in the ground.

In the spring the earliest shoots should be covered by earth with the hoe, and at intervals the ground should be kept clean by hoeing during summer—but otherwise no cultivation is needed—and the harvesting of the seed is proceeded with in August and September—the process being carried out generally at twice—the earliest flowered spikes seeding and ripening before the others, being cut off and tied in small sheaves, and carried out to dry in the open.

Turnips.—The earliest crops of white and yellow turnips are now ready for folding over, and sheep are by this time placed upon them, receiving some addition, as two lbs. of clover-hay chaff, and one lb. of malt coombs, or half lb. to one lb. of cake or pease, in addition to their daily food of roots, of which they will consume from sixteen to twenty-four lbs. a-piece, according to their size. It is not customary to cut these earlier turnips and give them in troughs. Each fold is daily pulled up either by hand or hoe in advance of the sheep, and as the land is generally still dry, the whole of the crop is eaten without waste.

It is not common to pull and harvest the Swedish turnip so early as this, and it is still probably not the rule to pit them at all. They are generally left standing as they grow, being, perhaps, in some cases earthed up for protection against frost by the double mould board plough passing down between the rows. But this, though it saves the crop in some measure from destruction by the weather, leaves in full force the greater mischief which both crop and land incur by the sprouting of the crop in spring. For this reason only it will profit the farmer to pull the crop and pit it on the ground when it is to be consumed on the land, or carry it off the field to the buildings if it is to be consumed in the yards.

Rape is generally ready in this month to receive sheep, which are folded over it as they are over turnips.

Mustard may be also ready either to be folded over, or to be ploughed under green.

Carrots should be pulled and harvested towards the end of this month. In this operation the spade is required; it is pressed into

the ground, and used as a lever by the right hand, while by the left the root is pulled up. Each man lifts two rows as he proceeds, and four men forming a company, eight rows are thus pulled and laid regularly on the ground in two lines. Two women can top the roots, *i.e.* cut the leaves off them, as fast as this number of men can pull them; and, leaving the roots in a central row, they throw the leaves into two lateral ones as they proceed. The carts, the number of which, varying according to the distance from the heaps, must be such as will convey the roots off the land as fast as they are ready, follow close upon the cutters; a man and a boy will be able, under ordinary circumstances, to fill both roots and leaves into separate carts as fast as those already mentioned can prepare them; and another man and boy will be able to pile the roots up in the heaps, and thatch and finish them off as they proceed. I mention all these details, because it is all-important to the speed and economy of the operation that the forces employed in the different parts of it should be rightly proportioned to each other.

The leaves, if they be already withered, may either be left on the ground and ploughed under, or, as on land already rich enough for grain crops, they may be carried away to the fold-yard and trod down by the cattle. When they are still green, they may be used as fodder; but as long as leaves are green they remain useful in the growth of the plant. The only reason why we should harvest our carrot crop before the roots have stopped growing, is their extreme sensitiveness to frost. This is so great, that it is of the greatest importance to secure before night all the roots pulled during each day; if they get frozen, though it be merely on the surface, it will be almost impossible to preserve them through the winter.

It deserves to be remarked that rotteness, when it is owing to any external cause, always commences at any cut or bruised portion of the surface. It thus becomes of importance that the surface of the roots should be cut or abraded as little as possible. The root fibres should not be cut off at all, and the leaves should be cut off so far from the crown of the root, as that they may fall separated from one another. If these points be carefully attended to, and if such a plan of harvesting be adopted as fulfils the three requisites of success alluded to with reference to the mangold crop, there is but little risk of the farmer losing much of his crop by heating or putrefaction before the spring.

Potatoes are harvested in October. They may be dug by spade or fork, the saleable ones gathered into baskets and put in carts in the field, and the "chats," or small and refuse tubers, also gathered and put in carts, for 21s. to 24s. per acre. If Hanson's potato-digger be used, the process is quickened and cheapened; it is a horse-drawn tool furnished with a horizontal blade drawn under the row, and a revolving fork, which scatters on one side all, both earth and

potatoes, which are thus moved. The tool will in an hour thus scatter on the surface as much as ten or twelve women and children will gather in nine or ten hours. The tubers should be taken either to house or pit, if not sold at once. The latter is perhaps the safest winter quarters for them. It is well to take them up rather late, if they are to be thus harvested, in order to be sure that the disease has run its course, and that the sound ones thus harvested will remain so. A hardened floor, about four feet wide, is provided, removing with the spade the moved and loosened soil on it, and the tubers are piled up ridgewise, and covered with straw and a foot depth of earth—the heap being left for some days only partly covered with earth, so that the drying process may be carried out somewhat, and not tend to the heating or fermentation and putrefaction of the mass. Some recommend covering with soil next the tubers, and covering lightly with thatch along the outside afterwards.

Autumn planting of potatoes has been recommended, but it is not now so commonly urged as it used to be. It is best to depend on thorough autumn tillage and manuring, and on the provision thus of a wholesome soil-bed for the tubers planted in the following March and April, as already described (p. 158).

In the districts where potato-growing is carried out as a regular part of the farm management, the crop is generally ploughed out of the ground—alternate rows in the field being first done and gathered, and then the odd ones left being ploughed in their turn; this gives more room for the operation of picking. The harrow or light grubber follows to bring hidden tubers to light. The double mould-board plough, with open-work or fingered mould-board, is the best implement for the purpose.

Vetches.—The second and last sowing of winter tares should be done this month, as the first is supposed to have been put in the ground early in September.

Beans and Peas.—In case a rop of beans should be preferred to one of winter vetches followed by turnips or cabbages, then towards the end of this month, as soon as the soil is thoroughly cleansed, cart on such manure as can be spared; spread it equally over the land, and immediately plough in one-bout ridges of two feet wide. The dung will lie safe, and the frosts will pulverize the surface. By doing this before bad weather comes, it will be possible, if the weather be open, to dibble the crop in February, which is of considerable importance.

On the same principle lands should now be ploughed for pease: making the ridges of the breadth which will suit the drill machine.—This is Arthur Young's advice, but probably it will now be generally preferred, either to sow winter beans, as already described (p. 474)—and the early weeks of October are not too late—or, if

preparation for a spring-sown crop be intended, to fallow and manure the land and plough it up in lands of the usual width, for the drill in February. Where steam cultivation after drainage is the rule, the land, after being manured, may be ploughed or grubbed, and left roughly till the proper seedtime.

Barley and Oats.—Whatever fields of stiff clay soil are intended for these crops, should be ploughed in this season for the seed earth, in order that no ploughing may be wanted in the spring. But the usual practice on ordinary soils is to take barley after the sheepfold, and the seed-furrow is then usually left until spring. Oats, again, in the north, generally follow grass or clover, which is ploughed now or at any suitable time during winter.

Wheat.—When wheat is sown, as it sometimes is after oats and barley, as much should be done to cleansing the stubble as is possible immediately after harvest, and a couple of cwts. of guano, with at least as much of common salt per acre, should be sown broadcast over the land, before the seed is drilled.

Flax.—Where the old practice of dew-retting flax prevails, it ought not to be carried on later than October. As farmers may now look forward to frost setting in, they should not risk the operations of watering or grassing the plant later than this, as it will be difficult to dry flax sufficiently to be built up in a stack-house, or scutched, even if frost does not make its appearance for some weeks to come. Where flax in the rotation follows barley or wheat, the stubble of those crops having been fallowed if necessary, should now, where intended for flax, be ploughed in lands of 3 to 5 yards in width, and as deep draining and deep ploughing are the only certain methods for success in cultivating flax to perfection, farmers would not regret adopting the Belgian system of some spade-labour, at least to the extent of having the furrows well trenched (say 18 to 20 inches deep), and all the stuff thrown up in a rough state on the top of the ridges, where the frost would mellow it during winter. If the top soil be mould of a light description, and the subsoil inclines to a heavy clay, a moderate dressing of lime would benefit it much, and prepare the stiff clay to mix down with and help to bind the light soil, when ploughed up in spring. Then if the land be not sufficiently strong, a top-dressing of liquid manure, previous to sowing, will ensure the growth of the best description of flax, care of course being taken in the selection of seed of the first quality.

Autumn tillage of stubbles must proceed all through this month. It was referred to at page 441. This process must be carried on unremittingly all through dry weather. Nothing can have a more fertilizing influence, especially on clay soils, than this breaking up of the land, and its exposure throughout its vast inner surface to the influences of air and weather. It is in the immense power which the steam-engine gives us for this purpose during dry

autumn weather that its chief value in cultivation is seen. But even where steam power is not yet available no opportunity should be lost of efficient autumn tillage.

Teazels.—This is the time for transplanting the young plants from the seed beds, over the field intended for the crop. And as this crop has not been mentioned before, it may be well at once to describe the usual cultivation of it. Teazels are suitable only to heavy clay lands.

A ten-acre field intended for them next year should have had an acre or thereabouts cultivated in early spring and seeded with perhaps a bushel of seed—the French teazel is largest and best. The rest of the field may have borne wheat or beans. It is to be ploughed and cultivated after harvest; and now the acre seed bed may be thinned to about eighteen inches apart, and the plants dibbled in at the same interval over the other nine acres. The land is to be spaded over once or twice during the spring and summer, and thus kept clean. And in August the process of harvesting commences; the teazels being cut as they ripen, *i.e.* lose their bloom and harden. Bunches are cut and tied and hung about over the plants till dry, when they are strung upon long poles and piled away under shelter till they can be trimmed, and sorted, and put on staves, and prepared for sale. The heads ripen in succession, and the harvesting is a work of four or five weeks. It is a hazardous crop—wet weather during July being destructive—the heads hold the water and rot, and thus lose that hard elastic thorn-tipped structure which makes them useful in the woollen manufacture. They are sold in “packs” of 40 staves, each carrying 20 bunches of 25 heads; and the crop varies from 3 to 10 packs per acre—4 or 5 being a common produce.

Orchards.—The produce ripens towards the end of October, and may be gathered carefully by hand, if for table—roughly, if for cider, laying them down in heaps upon the ground until it is convenient to take them to the mill. A new use for apples exists in a dyeing process, for which a large demand has this year (1861) arisen, so that a considerable rise in price has taken place.

Grass lands are best manured now while the land is dry, so that the process can be carried on without injuring the surface, and so that the first rains shall wash the “goodness” of the dressing into the land. Take care that the land be drained, however, or the rain will wash this “goodness” *off* the land instead of into it. Bone dust, eight to sixteen bushels per acre, may be applied with advantage, and if rotted first in heaps with damp sand so much the better. Well rotted farm-yard dung fifteen to twenty cubic yards per acre is the more common application. Spread it carefully and afterwards complete the process by drawing Cartwright’s chain-harrow over it.

Water Meadows.—The work of preparing the meadows for the

reception of the winter's flooding commences in September. The following is a report of actual experience :—

“The waterman or ‘drowner’ and his assistants commenced in September by cleansing the main drains, removing drift soil, and making up the banks. The hatches have also been attended to and repaired where necessary. These operations are generally paid for by the day or special contract. The working up is now being done, *i.e.* cutting out, with sharp-pointed spades or other implements adapted for the service, both carriage and drain, the soil and sward edgings being laid so as to regulate the water as it flows from the carriages over the beds, and we are now prepared to take advantage of the first floods, which are always more valuable than any other, containing the washings of yards, roads, and other highly fertilizing matters. The working up comprises a thorough adjustment of the levels, and perfect draining of the whole, and is usually let to the same man at from 2s. 6d. to 3s. 6d. per acre, according to circumstances and work to be performed.”

Land draining, to which full reference was made in the first pages of this book, may be proceeded with immediately after harvest—the whole plan of proceeding having been arranged before its commencement. All carriage of materials in accordance with this plan should be finished as soon as possible.

Odds and ends.—Roads should be put in thorough repair before winter.—All trimming and cleaning of fences should be completed, and if any ditches are still uncleaned, they should be at once cleaned out, and everything tending to the surface draining of the land completed.—All harvest tools, carriages, and machinery, should be cleaned, if necessary painted, and stored away in the dry.—Purchase cake and such cattle food as you may require.—Collect all the additions available for the increase of your farm-yard dung, as cut fern, leaves, dried peat dust, &c., and place in the yards a sufficiently thick layer to absorb all liquids that might otherwise be wasted.

The following is a picture of busy management in October, not of this year however (1861), on the lands of a clever Hampshire farmer :—

“We have to report a continuation of unfavourable weather for preparing the land for wheat sowing, and also for all kinds of farm work ; in this part of the county but a small portion of land intended for wheat has yet been sown, we fortunately put in the wheat upon a field of our coldest land in good order on the 20th inst. Our horses have been employed chiefly in carting manure on to the lea ground, also in sowing fallow land, since which they have been ploughing and pressing the lea ground for wheat. An odd horse is kept employed by carting swedes for pigs, cows, &c., carting hurdles for the removal of sheep, and carting clover for soiling horses and

cows ; we have this day finished cutting clover for horses, and shall now allow them hay, with a good allowance of beans and oats for the remainder of the sowing season. Labourers have been winnowing wheat, spreading manure on the wheat land, filling dung carts, trussing straw, trenching the water meadows, and cutting bedding from the salt marshes. Our shepherds are now fully employed with the sheep ; we have just begun feeding 100 dry ewes with swede turnips upon land intended for the wheat crop ; we give them a good allowance of beans and oilcake, but the weather being wet they do not make mutton fast ; our in-lamb Down ewes are changed twice a day from dry pastures to clover lea. Our horned ewes are now lambing fast, having between sixty and seventy fallen within the past fortnight, and are all doing well, the ewes bring many twins, and are free from lameness as compared with several past seasons. As fast as the ewes lamb they are put into young seeds, and changed into the wheat stubbles, which are now full of Italian rye-grass of the most luxuriant growth, which is the best kind of food we know of for suckling ewes : we have in past seasons sold lambs at eight to ten weeks old, to the butcher at Christmas, the ewes and lambs having been grazed upon Italian rye-grass and clover seeds, without corn or oilcake. We cannot help here alluding to the plan of autumn preparation of the wheat stubbles for the succeeding turnip crop, and we should very much like the advocates of that system to see our ewes and lambs at present feeding on the Italian rye-grass upon land intended for swede turnips next year, which practice has been uniformly successful for many years past, and we feel satisfied they would exclaim, autumn preparation must be wrong where crops of this value can intervene. Our women have been picking grass and weeds from fallow land, sorting potatoes in house, and picking up acorns, for which we pay them 9d. per bushel."

It is well to add in reference to the memorandum here about autumn culture that this farm is for the most part of light land on which autumn culture is comparatively of little service.

And as an illustration of the contrast which prevails between the earlier and later districts of the country, it must here be added, that in many localities, especially in some seasons, October, which is here witnessing the lambing of the flock and their feeding on productive Italian rye-grass among the stubbles, is elsewhere the chief corn-harvest month. A correspondent in Wester Ross thus spoke of it as the harvest-month in 1860 :—

"*Nov. 3.*—Notwithstanding the slowness of ripening and the continuance of rain, the long-looked-for harvest at length came. We commenced cutting 140 acres, with 8 scythes on the 10th September, and not until the 16th of October was the cutting finished. For the first 9 days we had pretty constant work, losing only one whole

day within that time. Afterwards our work was very much interrupted, both by unsettled weather and by want of ripe corn. On the 24th October carting to the stackyard was finished, with the exception of 4 acres of peas, which still lie weather-bound in the field. The harvest being protracted, and the crop more bulky than usual, the expense is necessarily increased."

October often sees a great destruction of young trifolium, and also of the young wheat plant, by slugs. The ravages of slugs are especially to be apprehended after much rain, and should as much as possible be guarded against. A few quarters of slacked lime spread upon either bean stubble or clover ley, before ploughing for wheat, is in general a preventive against them, and less costly than the more usual practice of sowing lime at night, after the vermin have attacked the young wheat plants. Two ploughings or effectual stirrings of bean stubbles at intervals are also a good preventive of slugs. Light land clover leas should be well harrowed after sowing, and properly consolidated by Crosskill's or some other heavy roller. Where the plant is up, and disappearing under these attacks, the only remedy is to sow hot lime dust and salt over the land at night when they are busy. Heavy rolling is also useful; and slowly driving a flock of sheep over the land will do good.

IV.—THE LIVE STOCK OF THE FARM.

The Stable.—Horses receive still a full allowance of hay and corn; and they may receive along with them some roots, and of these carrots are the best for use in the stable. October, although the days are shortening, is a hard month for horses. Labour is still heavy, and weather is becoming severe, and to the influence of this they are especially liable, owing to casting their coats. Good feeding, therefore, is on every account necessary. A warm meal of steamed roots, with hay-chaff and oats or barley, is a useful meal once a day, and may take the place of one of the feeds of oats which they would otherwise daily receive. The usual rations for the farm-horse during winter are given at page 58.

It is proper to add the following memorandum of the varying practice in different districts, as to the arrangement of the day's labour for the horses.*

The time of the Ploughman.—In the north one man tends and works each pair of horses, which are expected to be, in some districts nine, in others ten hours out of the stable. The men feed and groom their horses in the morning, being at the stable from half-past four or five for that purpose. They harness them ready to leave the stable at six o'clock, or, in some places, not till seven. They work them in the field till eleven o'clock, bring them in and feed them in the

* From the "Handbook of Farm Labour." Longmans.

stable between eleven and one ; work them in the field from one till six, and then bring them in and clean, bed, and feed them before leaving the stable about seven.

In the south it is a more common practice to employ a man (carter) and boy to every team of generally three horses. They are up between four and five. They groom and feed their horses till six, then get their breakfasts, and start work at seven. At mid-day they eat a bit of bread and cheese at the land's end in the field, and give the horses a mouthful of hay ; but, without any lengthened stoppage, they work on till at least three in the afternoon. They then return to the stable, give the horse a bait of hay, get their own dinner, feed and groom the horses, and leave at six, the team having been actually at work not more than eight hours during the day.

Yet another plan exists on some well-managed farms, where working the horses in the field, and tending them in the stable, are in altogether different hands. The ploughing and field work is done by young men, who work their full time (nine hours) with the teams in the field, and then merely groom the horses on their return ; the stable work, with this exception, viz., preparation of food, feeding, and bedding, is all done by the stableman and horsekeeper. The English method is best for training up the boys of the farm to horse work ; the Scotch plan is best for the quantity of work accomplished daily.

The Dairy.—The “ Gloucestershire *Dairy-woman*,” already quoted in these pages, reports of October, that cheese-making twice a day is generally given up in this month, and two meal or “ half-coward” cheese is usually made as long as there is a sufficient quantity of milk to make it once every day. The milk set up at night should be skimmed and put with that taken from the cows in the morning ; of course a larger portion must be warmed to make it a proper heat, and this must be ascertained by the dairywoman's experience, as she will be aware that it will require a greater degree of heat than in the summer, the process of making naturally tending to cool it at this season very differently from when made in the warm weather. The curd must be scalded in the manner recommended last month. The price of butter, increasing as it does at this season, makes it quite as profitable to take a part out of the cheese, and appropriate it to butter, as to allow all to remain, particularly as the milk is richer than in the spring, therefore it is recommended to convert the cream from the night's milk into butter.

The constitution of the herd deserves attention early in the season, and old cows which do not give rich milk, though they consume as much food as they used to do, should be displaced. They should not have been milked during August and September, in order that they may gain as much flesh as possible on grass—this being the most economical food on which to commence fattening stock

of any kind. They are, however, very hearty feeders, and should now be taken from the fields, as the grass can be more profitably given to other poor stock, while these cows should be pushed on by better food: early turnips may be given with advantage, with hay or cut chaff, and any addition of meal which may be found convenient, or this latter could be omitted until the last month, when this or a little oil-cake will improve the animals for the butcher. The weaning calves should now be in the grass fields only by day, and in yards with shelter at night, where they should be supplied with cut turnips and chaff, or the carrot-tops and swede-tops may take the place of turnips, these being supplied to them fresh, as the roots are by this time beginning to be secured for the winter; and for the next month the tops may be given with advantage to the cattle, for which they are best adapted. Should this food be given to dairy cows, a flavour is discovered in the butter, to prevent which, about a dessert spoonful of saltpetre should be put to every gallon of cream, and the whole placed in a tin vessel, and heated in warm water for about twenty minutes, the cream being frequently stirred during this time and allowed to cool very gradually.

Cows should towards the end of the month receive a mouthful of hay night and morning in the field. And in November they are taken out of the fields altogether for yard feeding during winter.

The Feeding-House.—Full-grown oxen bought in now at the fairs, or brought in half fat from the grass where they may have been receiving oilcake latterly in troughs in the field, are put up to fatten in yards a few together, in boxes singly, or in stalls. The second method is the best. They receive turnips or swedes either cut or pulped—in the latter case mixed daily with chaff of hay and straw and with three or four lbs. of barley or bean meal—in the former case, in alternate meals with hay, with once or twice during the day some broken oilcake. It is well to get gradually into the richer feeding, commencing with roots and hay alone, with a very small daily addition of cake and corn. To this subject we shall, however, refer more fully next month.

Swine.—The whey for the store pigs must now be considerably diminished, and their condition having been improved on the stubbles, they should now be sold; or those intended for fattening should get put upon better food; care being taken, before any of the stock are disposed of, to select the best breed, should any be required to take the place of the old sows. The whey not needed for the old pigs kept for stock, should be saved forward for them, to provide for the time when food is more scarce. The young pigs of the second farrows, which should be now two months old, may get a good supply of skimmed milk; as in most dairies, by this time, cheese is made only once a day, and therefore the evening's milk is frequently skimmed for butter. This milk, with a little mixture of

meal from any inferior corn, will soon make these pigs very nice pork, and with about six or eight weeks' feeding they should be quite fat. It is very desirable that porkers at this season should get their food warm; a little scalding water poured on the meal, and this cooled down with the skimmed milk, will make the food a proper warmth. A warm dry bed is also essential to their well-doing. Acorns may be gathered in and laid by as food for the older pigs; from one or two quarts a day is sufficient mixture with other food for each pig. The acorns are better for being kept a little while, until they begin to sprout, in which state they make much more wholesome food, than if given when gathered in fresh. Children will pick them up for 1s. per bushel, and a good deal of useful food may thus be added to the farm produce at a very cheap rate.

Now also put full-grown hogs to fatten: a business profitable, particularly in respect to the improvement of a farm by dung. If you get the market price for your pease, barley, beans, buck-wheat, potatoes, &c., and save carriage upon them, at the same time getting a fair price for swine, lean, you certainly make a considerable profit upon the whole transaction, though not an immediate one, as the mere fattener of hogs; but what is of greater consequence, is the raising of rich and valuable manure.

The most profitable method of converting corn of any kind into food for hogs, is to grind it into meal, and mix this with water in cisterns, in the proportion of five bushels of meal to 100 gallons of water: stir it well several times daily, for three weeks, in cold weather, or for a fortnight in a warmer season, by which it will have fermented well and become acid, till which time it is not in the best state for being served to the hogs. It should be stirred immediately before feeding. Two or three cisterns should be kept fermenting in succession, that no necessity may occur of giving it not duly prepared. The difference in profit between feeding in this manner, and giving the grain whole, or only ground, is so great, that whoever tries it once, will not be apt to change it for the common methods.

For the general stock of hogs, cabbages are this month of great use. Carrots, mangolds, and swedes are given, steamed or pulped, in small quantity, along with plenty of meal for fattening hogs, and in large quantity along with a little wash of meal for the store swine.

The Sheepfold.—The earlier horned ewes, in the southern counties where house lamb is fed for Christmas, are now dropping their lambs. Reference has been already made to this exceptional practice.

The rams are not yet taken from among the ewes in ordinary farm practice; and on the moorland farms of Scotland they are not generally admitted to the ewes until November.

Tegs (lambs) which have been on clovers, &c., during the summer, are put on the earlier turnips and rape this month and folded there, receiving in addition to their daily food some hay-chaff; and when the object is to bring them out ready for the butcher immediately after taking their coats in spring, they should be gradually brought to some richer feeding by the addition of pease, or barley, or oilcake, whichever may be cheapest—beginning with less than $\frac{1}{2}$ lb. a day a-piece. Shearlings which may be fattening for Christmas time or thereabouts should receive either in the turnip fold or in yards, as already directed, a larger allowance of corn or cake with their green food.

All this is the practice of the lowland districts. Among the moorlands where sheep husbandry is confined to the breeding of the black-faced or Cheviot sheep a very different practice prevails, of which the following report from the Lammermoor farm is a sufficient illustration:—

“October 10th.—We are now in the midst of harvest, and rain and snow have this day been falling. Cutting is not yet finished in the district, and much grain was shaken by the wind of last Wednesday. On the earlier farms a good deal of corn has been stacked, but on the higher lying and later ones, little more than a beginning has been made. Turnips look well, and every endeavour will be made to secure them against frost, either by storing or earthing up in the drill. The latter practice, however, though serviceable in an ordinary winter, does not always prove sufficient to protect them. We have heard another method recommended, viz., pulling three or four drills together, running a deep trench with the plough in which to place them, and again with the plough covering them well up. Our hill flocks have now again in great measure regained their condition, as the summer has been a good one for hill pastures, and keep abundant. But we question very much how they would stand a second bad winter. Our stock of rams is provided, and we have taken turnips for them elsewhere, that they may be out of the way of mischief, and be in good condition when they are required, about Martinmas (Nov. 11).—The bathing of the sheep will commence in about ten days, and will occupy our shepherds for a fortnight. This year we intend using the turpentine bath, a preparation which both improves the quality of the wool and kills all vermin. The cost is about $2\frac{1}{2}$ d. per sheep.”

Bathing the sheep is an operation for the purpose of killing the sheep ticks and of meeting any tendency to cutaneous eruption. The bath is generally a decoction of tobacco mixed with spirit of tar and soap, and it is poured in upon the skin of the sheep along seams of parted wool, two or three inches apart, so as to thoroughly wet the whole surface of the skin.

NOVEMBER.

The weather of November is sufficiently illustrated by our monthly meteorological table on the following page.

The operations of the Farm.—We propose this month (1) to enumerate and shortly characterize *the various breeds of the live stock of the farm*. Farm operations include—(2) *field work*, such as finishing wheat sowing and root harvest, ploughing stubbles for next year's green crops, grass land management, &c. ; (3) *live stock management* in the stable, feeding-stall, dairy, sheepfold, and pigsty.

I.—BREEDS OF LIVE STOCK.

We must be satisfied with extremely short memoranda on the characters of our different breeds.

The Horse exhibits several distinct breeds, originating in the various districts of the country when there was less intercommunication than there is at present, and when peculiarities of the locality therefore exerted undivided influence for generation after generation on the animals bred in it, so that they ultimately acquired a distinctive character. (1.) The black dray horse of England is proper to the rich pastures of the central and eastern counties. He is a heavy animal, and thus of inferior value for the farm, but especially adapted by his weight and strength for heavy draught and road use. (2.) The Clydesdale is one of our best farm horses—of a grey, brown, or black colour, combining strength with activity in the most generally useful proportion for field work ; of generally a good temper ; of good, rather large, size. He is the model of a well-made horse for agricultural purposes. (3.) The Suffolk Punch, smaller than the Clydesdale, of a rounder and more compact form ; of smaller bone ; generally of a chestnut colour ; of steady and resolute temper ; he is the best possible combination of strength, activity, and quality generally as an agricultural horse for light land districts. (4.) The Cleveland, a breed originating in Yorkshire, is now a carriage horse rather than a farm horse. Tall, of a bay colour, not of so heavy or compact a build as the other breeds named, this breed now furnishes horses for the carriage and for the hunting-field rather than for the farm. We add in a foot-note a memorandum of the fairs where these breeds are to be seen.*

* The best show of *Clydesdales* is at Edinburgh All Hallow fair, Nov. 11 and 12 ; at the fairs at Glasgow, at Rutherglen, near Glasgow, and at Dumfries, Feb.

THE WEATHER OF NOVEMBER.

LOCALITY.	AUTHORITY.	Mean temperature.		Highest mean temperature.	Greatest heat.	Lowest maximum heat.		Highest minimum cold.	Average amount of rain.		Smallest amount of rain.	Greatest amount of rain.	Average number of rainy days.		Smallest number of rainy days.	Greatest number of rainy days.	No. of years' observations.
		Lowest.	Highest.			Lowest.	Highest.		inches.	inches.			inches.	inches.			
Guernsey...	Dr. Hoskins, F.R.S.	48.3	44.5	52.0	61.5	53.0	41.0	30.5	4.0	8.4	16	9	24	13			
Helston	Mr. M. P. Moyle...	49.6	45.6	53.3	64.0	58.0	36.0	27.0	3.8	8.2	15	7	24	16			
Exeter	Mr. W. H. Ellis.....	44.3	41.7	48.1	62.8	54.2	33.7	21.2	2.7	4.5	16	9	23	8			
Ventnor, I. of Wight	Dr. Martin	47.6	42.4	51.9	64.0	53.0	37.0	26.0	2.9	7.4	15	9	27	22			
Worthing, Sussex	Dr. Barker	43.9	41.7	49.5	60.7	51.8	37.5	22.8	2.7	6.7	14	7	24	9			
Clifton near Bristol	Mr. W. Burder, FRAS	41.6	39.6	44.9	61.9	53.5	31.4	21.0	1.9	3.0	15	11	23	8			
London Royal Observatory..	{ The Astronomer } { Royal, F.R.S. }	42.4	34.7	49.2	66.3	52.3	38.0	19.4	1.8	6.0	12	7	22	90			
Bedford	Dr. Barker, F.R.A.S.	41.9	37.5	46.7	61.0	50.0	33.0	11.0	1.8	5.4	13	8	23	10			
Lampeter, near Cardigan.....	Rev. Prof. Matthews, M.A.	41.8	39.8	45.0	64.2	52.4	27.6	5.8	3.0	6.3	13	7	18	6			
Norwich	Mr. W. Brooke, FRAS	42.0	37.1	47.1	65.0	50.0	33.0	20.0	2.8	5.9	16	10	26	21			
Highfield-House Observatory..	Mr. E. J. Lowe, { F.R.A.S. }	42.4	36.4	48.8	61.2	52.5	30.0	17.5	2.0	7.2	15	8	24	51*			
Oxford Observatory	Rev. R. Main, F.R.S.	43.0	37.6	45.7	63.9	50.8	31.5	15.7	2.4	7.1	14	7	23	34			
Grantham	Mr. J. Jeans, F.R.A.S.	41.3	39.7	45.7	62.6	51.2	30.3	20.4	2.0	5.4	17	12	25	10			
Hawarden, Chester	Dr. Moffat, F.R.A.S.	42.1	38.7	46.4	62.5	50.0	32.0	20.0	2.3	5.9	12	5	27	11			
Manchester.....	Mr. G. Vernon FRAS	41.2	35.6	45.0	66.0	51.0	29.0	16.6	2.2	4.5	13	10	24	12			
Leeds	Mr. H. Denny	42.6	41.0	46.0	67.0	53.0	28.0	20.0	1.9	5.2	15	11	23	10			
York	Mr. Ford	40.2	36.0	44.0	62.0	52.0	30.0	16.0	1.9	4.2	15	9	24	20			
Scarborough	Mr. B. Cooke	43.3	41.8	46.8	59.0	50.5	33.4	27.2	2.0	3.7	11	2	15	6			
Isle of Man	Mr. J. Burnan, FRAS	44.3	42.9	47.0	58.1	54.3	32.0	25.9	2.8	4.4	13	8	18	7			
Durham Observatory	Mr. A. Marth, FRAS	41.1	37.4	44.8	60.3	49.8	27.8	18.4	2.0	3.9	15	7	23	14			
North Shields.....	Mr. R. Spencer	42.0	38.0	45.0	61.0	48.6	32.7	22.3	3.2	9.9	18	8	26	23			
Silloth	Rev. F. Bedford, FRAS	41.8	39.3	45.7	60.8	53.2	28.5	12.0	2.3	5.8	10	6	14	7			

* Observations at Highfield House on temperature extend over fifty years, and at the Royal Observatory over ninety years.

To the notices given in past pages (see Index) of the breeding, feeding, and general management of the horse, we have now only to add the following memoranda from M. Rousseau, quoted in the "Book of the Farm," on the dentition of the horse as indicating age:—

"The milk-teeth of the horse consist of twelve incisors, six in each side of the head; and of molars sixteen in number, eight on either side of the head,—in all twenty-eight teeth. The teeth of the second dentition are forty in number, of which twenty-eight have replaced the milk-teeth. Those between the incisors and molars, called the canine or tusks, do not appear along with the teeth at an early age. Others complete the arch by occupying the room made by the growth of the jaws; these are new molars which come out of both jaws. The full set consists of twelve incisors, four canines, and twenty-four molars, in all forty in number.

"'This is the order of coming out of the second or permanent dentition of the horse,' observes M. Rousseau. 'The first permanent molar, which is situate behind the last milk-molar, presents itself before any of the milk-teeth have fallen, and makes its appearance upon the maxillary arch from the eleventh to the thirteenth month after birth; it will be, by numerical number, the fourth persistent molar, when all the milk-molars have fallen. The fifth permanent molar, which is situate behind the preceding tooth, breaks the edge of the socket from the fourteenth to the twentieth month. During this time the decaying teeth die from their roots, and wear down their crowns to such a degree, that the hollow which characterizes the surface of the incisors at certain periods cannot be observed, so

13, Sept. 25, Wednesday before Nov. 22; and Ayr, on the Thursday before the second Wednesday in January.

Clevelands are to be met with at Newcastle-on-Tyne, on August and October fair days; at Stagshaw, near Hexham, on the Saturday before Whits.; at Durham, on March 31; and especially at Yarm, in the Cleveland dist., Yorkshire, on Oct. 18 and 19; also at Northallerton, on Feb. 14; at Howden, Sept. 25, &c.; and at Brough-hill, in Westmoreland, on Sept. 30 and Oct. 1.

Suffolk horses are met with, besides the principal fairs in their own county, at some of those in Essex; at Colchester, on July 5; at Newport, Nov. 17; and Rayleigh, Trinity M.

The large *Black Dray* horse is to be met with chiefly at the large fairs in Northampton, Bucks, and Lincoln shires; as Northampton, Aug. 26; Aylesbury, Palm Sat.; Wisbeach, Thurs. before Whits.; Boston, Nov. 18, 19, 20; and especially Horncastle, Aug. 10—20.

The *Shetland* pony is shown in droves at many of the fairs in the north of England, especially at Newcastle-on-Tyne; the Welsh pony at all Welsh fairs, especially Llan Rhaiader yn Mochnant, Denbighshire, July 24.

The largest fairs for horses in the kingdom are Horncastle, Lincolnshire, between the 10th and 20th of August, when large numbers of all kinds are exhibited; Howden, Sept. 25, &c.; Newcastle-on-Tyne, Aug. and Oct.; Rugeley, Staffordshire (1st week in June), Brough-hill, Westmoreland, Pershore (June 26), and others.—*Morton's New Farmer's Almanack.*

that the veterinarians call them lost-mark. The central incisor or pincer is ordinarily of the ninth or eleventh month; the lesser incisor from the eleventh to thirteenth month; and the lateral incisor, or corner tooth, from the fourteenth to the twentieth month. Once these teeth cease to have mark they bear upon their surface a smooth trace, brown and indelible, which diminishes the more that the teeth approach their fall. The first permanent molar replaces the first and second milk-molar from two years to two-and-a-half years. The central incisor appears upon the edge of the socket after the coming out of the fifth permanent molar, from two-and-a-half to three years. The second permanent molar replaces the third milk-molar a little after the same term, or one or two months of difference. The third permanent molar replaces the fourth decaying molar at three years; at this time also appears the sixth and last molar. The lesser incisor from three-and-a-half to four years. The canine or tusks appear from four to four-and-a-half years. At last, the second dentition is ordinarily terminated by the lateral incisor or corner-tooth."

Remarks on the breeding and management of the horse are given in past pages (*see* Index). We find, however, that we have omitted to state on the period of gestation that the mare goes with young about eleven months. In order to bring forth in May she should be put to the horse in June.

The Ox.—The principal breeds are the Short-horn, Hereford, and Devon; and besides these we have the Sussex, the Long-horned, the Galloway, the Angus, and the Kylvie. Very short memoranda are all that we have room for.

(1) The Short-horn is now undoubtedly the dominant breed. Originating in Teeswater, and carefully bred years before the existence of any herdbook recording descent, it soon reached the highest reputation for its early precocity and meat-producing qualities.

The Rev. H. Berry, who is the historian of the breed, in a pamphlet published in 1824 drew up a long list of instances of extraordinary merit in animals of the old Short-horn or Teeswater breed.

The originals of the improved short-horn were long deservedly celebrated as a valuable stock, and their descendants are not a breed as to excellence of yesterday, or liable therefore to degenerate to-morrow. They possess the important advantage of being descended from a long line of animals in which there existed in an eminent degree the good points which are now admired in the best-bred instances of the improved short-horn breed.

The extraordinary prices reached at the sales of noteworthy herds of well-bred short-horns shows how great a value has all along been placed upon the sort.

At Charles Colling's sale, in 1810, seventeen cows, seven heifers, five heifer calves, eleven bulls, and seven bull calves, in all forty-

seven animals, were sold for 711*l.* 17*s.*, averaging about 151*l.* 8*s.* At Robert Colling's sale, in 1818, thirty-four cows, seventeen heifers, six bulls, and four bull calves, in all sixty-one animals, sold for 7858*l.* 4*s.*, or 128*l.* 16*s.* apiece. Coming down to 1846, there were sold of the late Earl Spencer's herd at Wiseton, 104 cows, heifers, and calves, and nineteen bulls, in all 123; they fetched 8468*l.* 5*s.*, averaging 68*l.* 17*s.* apiece. At Mr. Bates's sale at Kirk-leavington, forty-eight cows, heifers, and calves, and twenty bulls, fetched 67*l.* apiece. At the Tortworth sale of the late Lord Ducie's herd, in 1853, sixty-two animals, of all ages, fetched 9361*l.* 16*s.*, or 150*l.* 19*s.* apiece. At the Hendon sale, two years later, Mr. Tanqueray's herd of 101, of all ages, averaged 77*l.* 13*s.* 4*d.* At Mr. Harvey Combe's sale, Cobham Park, 1859, sixty-three, of all ages, sold for 4838 guineas, averaging 80*l.* 12*s.* 4*d.* each, being thus about on a par with the herds of Mr. Ambler, Mr. Majoribanks, and Sir C. Knightley, of the previous year, which sold—fifty for 84*l.* each, fifty-nine for 90*l.*, and seventy-eight for 80*l.* apiece, respectively. At Mr. Wetherall's sale, in 1859, forty-eight, of all ages, fetched 3504*l.* 18*s.*, or 73*l.* 4*s.* 6*d.*

Since then, many herds have been disposed of by auction at high prices, as Mr. Adkin's, of Milcote, fifty-one at 61*l.* 18*s.* apiece; Mr. Bolden's, of Lancaster, twenty-nine at 87*l.* 17*s.* each; Mr. Dud-ding's, of Panton, Lincolnshire, 100 at 49*l.* 11*s.*; Captain Spencer's, thirty at 66*l.* 16*s.*; and this year (1861), Mr. Sanday's, of Leicester-shire, sixty-five at 53*l.* 11*s.*

These prices sufficiently indicate the high value placed upon the breed. A still more extraordinary estimate is placed upon certain families of the short-horn breed; and the names of particular breeders, as those of Bates, and Booth, and Towneley, confer a high market value upon stock descended from their herds. The history of one of these families—the Duchess tribe, of Bates' breeding—is given at page 470. And extraordinary instances of high price, up to 700 guineas for a single cow, 500 guineas for a calf, 1200 guineas for a bull, can be quoted as paid for individual animals. But it is not in special instances of this kind, but in the general circumstances of the stock over large districts, that the influence of the short-horn breed is seen. They have crossed, probably, every breed in the country, and the first cross, of course, is everywhere a great improvement upon the inferior breed.

(2) The Herefords, another leading breed of cattle, characterized by red body and white or mottled face, come almost as early to maturity as the short-horn, and attaining great weight, are certainly one of the best breeds in the country. They have as great an antiquity as the short-horn: and, like that breed, with its indebtedness to the Colling's, they owe much to the perseverance and ability of Mr. John Price. His sale was signalized by the sum of 1000*l.* being

given for a bull and cow; and high prices are fetched still, though not so high as those of the short-horn stock, for well-bred bulls and cows.

The breed has now a herd-book of its own, and it is in the hands of as much enthusiasm and ability as has characterized the history of the short-horns. For early maturity, and large size accordingly, it now almost equals the short-horn; and for quality of meat it probably excels it.

(3) The Devon. The North Devon ox is a small animal, of a light red colour, without any white, with long yellowish horns, and a well-made symmetrical frame. Hardy, light, and active, it is an excellent worker, and is worked in harness until five or six years old, and then fattened. The pure-bred cattle of the Quartleys, Farthings, Turners, Davys, and others, including H.R.H. the Prince Consort, fetch high prices; and the breed, though smaller and of less national importance than the other, is likely to hold its own against them.

(4) The Sussex is a larger, coarser animal than the Devon, but otherwise resembles it. Recent shows of fat cattle have proved its merits as a meat-producing animal.

(5) The Long-horned, a dairy breed rather than one adapted for the feeding-house, is gradually disappearing from the midland and western counties, where it prevailed.

(6) The Kyloe, or West Highlander, adapted to the rough pastures of the districts where it is bred, is driven south to be fattened on English grazing grounds, where it yields the very best of beef at four and five years old. It is characterized by long upturned horns, a shaggy coat of a yellow dun or black colour and well-made, compact little body.

(7) The Galloway, resembling a Kyloe without horns, with a less shaggy coat, is, when well bred, one of the best-made and most symmetrical of our breeds of cattle. It, too, is driven south in large numbers to be fattened, and yields excellent beef.

(8) The Angus, also a polled breed, of a red or black colour, is a much larger animal, and when crossed with the pure-bred short-horn breed, furnishes one of the best crosses for the feeding-stall that we have.

Besides these there are other sorts especially adapted to the dairy. The following memoranda on our dairy breeds are condensed from a lately published "Handbook of Dairy Husbandry":—

Of the many distinct breeds of cattle cultivated in the United Kingdom, from all of which of course dairy produce is to some extent obtained, only four or five can be enumerated as strictly dairy breeds. Among these are the short-horn, the Channel Island breed, the Ayrshire, the Suffolk, and the Kerry. The short-horns,

* "Handbook of Dairy Husbandry." By J. C. Morton. Longman.

which, excepting where there is a local breed of any particular merit, as the Hereford, Devon, Ayrshire, Alderney, &c., are more or less influencing the character of all our cattle, are becoming more and more the principal dairy breed of these islands. In the midland counties the long-horned breed does indeed still retain its place in dairy herds, and yields well enough to justify its retention. But elsewhere the Devon, a much smaller animal, yields but a small quantity of milk; the Hereford, an animal of nearly equal size, is also deficient in its yield, and in neither of these counties does the prevalence of a peculiar breed produce anything like a general dairy husbandry. The short-horn is more especially perhaps distinguished for its precocity and excellence as a meat-producing animal—but many of the strains of even the pure bred short-horn are also remarkable for their yield of milk—and its crosses with other native breeds, together with that more ordinary style of short-horned animal known as the Yorkshire cow, surpass all others for their yield of dairy produce, whether milk alone, or the butter and cheese made from it. It has the advantage over all other sorts, that its calves make more valuable oxen, and its cows, after five or six years' milking, are more easily turned into beef. The milk, compared with that of other smaller breeds, is remarkable rather for quantity than quality, and therefore it is adapted either for direct consumption, or for the production of cheese, rather than of butter. For this reason, while taken for town dairies, or for the cheese-producing districts, the Ayrshire, or the Channel Island sort is preferred by those who merely wish a home supply of dairy produce for the house.

The Suffolk, a much smaller animal than the short-horn, is a hornless breed, of great excellence for the dairy, though standing comparatively low on the scale as a meat-producing sort. Like all good dairy animals, its cows are unequal in their form, narrow and small before, compared with the development of the hind quarters. They are now generally of a light red, red and white, or yellowish and white colour. They are good milkers, and as the Suffolk dairies are mostly for the production of butter and skim-milk cheese, the milk is of tolerably good quality; best, however, as it always is, in those instances where the quantity is not the most abundant.

The Channel Island cow, in which faults as a fattening animal, and merits as a milk-producer, generally both in an exaggerated form, are combined, is the favourite of the small or household dairy. The quality of its milk is so good, that not unfrequently one (or more) of this breed is kept even in large dairies, where the large-framed Yorkshire cow forms the majority of the herd, for the sake of the enrichment of their produce by the mixture of its own. On the other hand, the butter from milk of Jersey cows is improved if

this rich milk be mingled with the more watery produce of a larger cow.

The Ayrshire, though too small for the productive pastures of our English dairy districts, and involving, owing to the greater number that must be kept on a given extent of ground, more labour than the larger dairy breeds there prevalent, is one of the most useful dairy animals we have. It possesses more perfectly, perhaps, than any other sort, the external features which a good cow ought to exhibit, and withal it displays a greater aptitude to fatten than our other small dairy cattle generally have. It yields a remarkable quantity of excellent milk, which, if less rich than that of the Guernsey or Jersey cow, is better adapted for churning and for cheese-making; and it is elegant enough in form and colour to be an ornament to the park. It is generally short-horned, red and white, small boned, and with light forequarters.

The Kerry breed of cattle are remarkable for their small size, and comparatively with it their large yield of extremely rich milk. This character they possess in common with other small and mountain breeds of cattle.

We add in a foot-note, from the "New Farmer's Almanack," notices of where the different herds are to be seen and purchased.*

* *West Highland* cattle and Scotch cattle generally, are shown in large numbers at the Falkirk Trysts, 2nd Monday of Sept. and Oct., when from 20,000 to 30,000 are shown; at Muir of Ord fairs, Inverness, and all Scotch fairs; also at Newcastle October fairs; at Stagshaw in the same county; at Brough-hill, Westmoreland; at the Norwich markets, and at Barnet fair on the 1st week in Sept.; Northampton, Aug. 26.

Galloways are met with at all the fairs in south and west of Scotland; at Carlisle, Penrith, Rosley-hill Whit-Monday, Brough-hill, Newcastle, &c.

Short-horns.—The fairs at Newcastle-on-Tyne, Durham, Darlington, Yarm in Yorkshire (Oct. 19 and 20), Northallerton, Northampton, Boston in Lincolnshire, Stow-on-the-Wold, Gloucestershire, are remarkable in their several districts for this breed. Of these, Newcastle, Darlington, and Yarm, are probably the best.

Herefords.—The best shows of Hereford stock are at the fairs in Herefordshire in the month of Oct.; at the great market in Hereford itself, Oct. 20; at Leominster in March, and Oct. 17, at the fairs in Monmouth and in Ross great numbers of well-bred animals are shown. Among the other fairs we may enumerate those of Shrewsbury, Wolverhampton, Birmingham, Gloucester, and Barnet in Hertfordshire, in Sept.

Devons are shown in their own county at South Molton, Sat. after Feb. 13; Crediton, Saturday before last Wednesday in April; Sampford-Peveril the following Monday: Exeter, Feb. 10, May 19, July 21, Dec. 8; North Molton, 3rd Wednesday in May, and last Wednesday in October; also at Barnet fair, 1st week in Sept.; Boughton Green, Northampton, June 24, 25, 26.

Sussex cattle are rarely met with out of their own county and its neighbourhood (Lewes, May 6).

Channel Islands.—One of the best fairs for this stock is Southampton, Trinity Monday.

Ayrshires are met with in abundance at the fairs in the south-western counties of Scotland, the principal probably being Ayr (last Friday in April), for cows, barren and in calf, and young cattle.

The breeding, feeding, and management of the ox are described in past and future pages of this book (see Index). We add from Professor Simonds the following table of the dentition of the ox, as indicative of its age. As animals are better bred, they exhibit greater precocity in this as in other qualities; and two tables are therefore given of late and early growth respectively.

Animals which, at two years of age, exhibit all the external character, as regards size, weight, and general development, which they used to do at three or even four years old, will be found as far in advance of their former indications in detail as they are upon the whole; and their teeth, as well as frame and flesh, are proof of this. The tables in which Prof. Simonds gives the results of more than 2000 observations, are strikingly illustrative of this. They are as follows:—

Dentition of the Ox.

TABLE OF EARLY AVERAGE. The breed and other causes favouring development.			TABLE OF LATE AVERAGE. The breed and other causes retarding development.		
Yrs.	Months.		Yrs.	Months.	
1	9	Two permanent incisors.	2	3	Two permanent incisors.
2	3	Four " "	2	9	Four " "
2	9	Six " "	3	3	Six " "
3	3	Eight " "	3	3	Eight " "

The Sheep.—(1) Of all its varieties and breeds the Leicester probably has hitherto exerted the greatest influence on the merit of sheep stock generally throughout the country. It has improved, by its crosses, the long-woolled breeds of the country, more especially the Lincoln, and the Cotswold, which retain their names, although they are certainly, to a great extent, altered in character by the admixture of the Leicester blood. It has also induced a useful alteration in the character of the Cheviot breed. In its relation to the Downs, and other short-woolled breeds, it has had most influence as producing a cross-bred animal for feeding, not for breeding from.

The Leicester owes its present improved form to Robert Bakewell, of Dashley, and his successors. He first directed his attention to the improvement of the carcase, which he carried to the extent of rather neglecting the fleece of the sheep.

Such value was ultimately attached to his sheep, that in 1789 he made 1200 guineas by letting three rams, and 2000*l.* by seven others.

(2) The breeds which probably have, most of any, directly been improved by gradual Leicester crossing, are the long-woolled, Lincoln, and Cotswold. The former is the largest sheep in the island.

A three-shear sheep has been known to weigh 96 lbs. a quarter, and fleeces of 16 lbs. and 18 lbs. have been yielded by them.

(3) The Cotswolds are generally considered the best of our long-woolled breeds. They possess a large, wide frame; ribs well sprung out; firm, broad, and often overhanging rumps; full hind quarters, and good thighs; chest full and prominent, but sometimes somewhat defective in depth. The flesh is often rather loose, and not well intermingled with lean. A good Cotswold flock will yield fat mutton after losing their first coat at fourteen or sixteen months old, 20 lbs. to 24 lbs. a quarter.

The Cotswold ram as well as the Leicester is used to cross the Southdown (the produce is a heavier sheep than the mother, and sells for as much per lb.) but it is best in that case to keep a pure bred Southdown flock and cross it with a Cotswold ram, and sell the produce, not breed from it.

(4) The Southdown is probably the most popular breed in England with the butcher and consumer, and the prices fetched at the annual lettings and sales of such men as Jonas Webb, Rigden, and others, prove that it is still considered one of the most generally useful sorts we have.

Although the higher relative price of the long-wools of Leicestershire and the Cotswolds is bringing back the fashion towards these breeds, yet the Southdown and its related breeds still occupy to a great extent the dry arable soil of England. The pure-bred Sussex down has, like the Leicester upon the long-woolled breeds, exerted an immense influence on all the short-woolled breeds. And thus Hampshire and West Country downs are sheep of much better quality than they used to be.

(5) Shropshire sheep must be named upon our list as one of the short-woolled native breeds of England which has latterly very greatly risen in public notice as a large-framed, close-woolled breed, possessing early maturity, hardiness, and good quality.

(6) The mountain breeds, including the Cheviots and blackfaced, must be merely named. Their management will be gathered from the memoranda of a Lammermoor farm which are given at monthly intervals in this volume. The early Dorset breed, too, must be merely named here. It has been described elsewhere (see Index).

We add in a foot-note memoranda of the principal sheep fairs of the country.*

* The *Blackfaced Breed* is met with in all the Scottish fairs. The Falkirk Trysts, Sept. 10 and Oct. 10; the Inverness sheep market, 2nd Thursday in July; Muir of Ord, 3rd Wednesday of April (half-bred hoggets); Slateford market, 1st Monday in May; Castletown of Braemar, last Wednesday of April; Brechin, 3rd Wednesday of April and 2nd Wednesday of June; Kirriemuir, last Friday of April and 1st Tuesday after 18th Oct.; West Linton, 3rd Wednesday in June. Also in England at Stagshaw, Brough-hill, &c.

Cheviot.—The best fairs are Lockerbie, Aug. 13 (if that be Saturday, Sunday, or

The following is Professor Simonds' statement of the dentition of the sheep as indicative of age :—

Dentition of the Sheep.

TABLE OF EARLY DENTITION.					TABLE OF LATE DENTITION.				
Yrs.	Months.				Yrs.	Months.			
1	0	Central pair of temporary incisors replaced by permanent			1	3	Two permanent incisors.		
1	6	Second pair	"	"	3	0	Four	"	"
2	3	Third pair	"	"	3	9	Six	"	"
3	0	Fourth pair	"	"	3	6	Eight	"	"

Of the relative merits of the different breeds of cattle, sheep, and pigs, as meat manufacturers, strange to say, we have no unexceptionable evidence. It is so difficult to select perfectly representative animals as specimens of the breed to be tried—so necessary to treat each in the manner in which its merits shall most directly appear—so impossible to draw a true comparison of the causes and of effects, when the treatment differs, as it ought to do with age and breed—that such experiments as have been published cannot be trusted as conveying general truths. Mr. Lawes made an elaborate investigation into the subject, comparing Hampshire and Sussex downs, Cots-

Monday, then on the following Tuesday), for lambs; Moffat, Friday after 2nd Monday of Sept. (rams and other sheep); Langholm, July 26 (lambs); Sept. 18 (rams, and other sheep); Dunse, 4th Tuesday of March (hoggets in wool, and ewes in lamb), 3rd Tuesday of May (sheep for grazing) 2nd Monday of July (lambs and wool), 3rd Thursday in Sept. (draft ewes); Lauder, Friday before 12th July; St. Boswell's Green, July 18; Melrose, Aug. 12, and in England at Stagshaw (Friday before Whits.); and Brough-hill Sept. 30, and Oct. 1.

Leicester sheep are shown in the north of England at Newcastle market, at Brough-hill in Westmoreland, at several Yorkshire fairs, and generally at the fairs in central England, among which especially may be named those of Northamptonshire, Leicester, &c. We name also Kelso, on the 2nd Friday in Sept.

South Down sheep—Lindfield, Sussex, Aug. 5 (lambs); Lewes, Sept. 21 (ewes); Horsham, Sussex, July 18 (lambs); Battle, Sussex, Sept. 6; East Ilsley, Berkshire, July 1, Aug. 26, Sept. 24; Abingdon, Aug. 5; Weyhill, Oct. 10 to 15 (largest fair in England for South and Hampshire Downs, also for Dorset sheep); Wilton, Wilts, Sept. 12.

Dorset sheep are best procured at Appleshaw fair, Hampshire (Oct. 7 and 8, Nov. 4 and 5); at Toller-Down, Dorset (Sept. 7); and at Weyhill, Oct. 10.

Cotswolds are procurable at the fairs in the counties of Gloucester, Oxford, Berks, and Wilts, as Stow-on-the-Wold (May 12, Oct. 24); Burford (Sept. 25, last Saturday in April); Marshfield (Oct. 24).

Romney Marsh sheep are best procurable at Romney (Aug. 21); Eastry (Oct. 2), in the county of Kent; and the other long-woolled kind, the *Lincoln* sheep, are shown in large quantities at Boston, Gainsborough, Grimsby, Grantham, Partney (Aug. 25), and other fairs in Lincolnshire.

The *Exmoor* breed is to be obtained at the fairs in North Devon.

wolds, Leicesters, cross-bred wethers, and cross-bred ewes, giving forty of each kind oilcake, hay, and swedes during five or six months, and weighing food and increase; and the following, stated generally, are the results arrived at:—

Of the six lots experimented upon, the Cotswolds gave by far the largest average weekly increase per head; indeed, about half as much more than either the Sussex, Leicester, or cross-bred sheep, and nearly one-fourth more than the Hampshires, which were the second in order of rate of increase per head per week.

Leaving the point of the amounts of food consumed per head, the variations in which, as far as the dry foods are concerned, depended on the varying original weights of the different lots; and looking only to the amounts consumed per 100 lbs. live weight of animal, or to produce 100 lbs. of increase, it was found that, although the oilcake and clover chaff were in each case given in proportion to the original weights of the sheep, yet the result was that, taking the average throughout the entire period of the experiment, the Leicesters had less of these dry foods in relation to their average weight than any of the other lots, and more particularly than the Hampshires, Sussex Downs, and Cotswolds. Notwithstanding this, however, the Leicesters also ate less in relation to their average weight of the turnips, which they were allowed *ad libitum*, than any of the other breeds. This less consumption of total food in relation to their weight by the Leicesters might be in their favour, if the result were that they consumed also less for the production of a given amount of increase. But the fact was, that, in relation to the increase they yielded, the Leicesters consumed quite as much food as the cross-breds, and notably more than the Cotswolds. Leicesters, cross-breds, and Cotswolds, however, all gave a larger amount of gross increase for a given amount of food consumed than either the Hampshires or the Sussex sheep. Such were the results of the experiments as they stand on the point of the amount of food required to yield a given amount of increase. But we must not forget that the trials were not all made side by side and in the same season; those with the Hampshires and Sussex Downs being made together in 1850-1, those of the Cotswolds alone in 1851-2, and those with the Leicesters and cross-breds in 1852-3. And although the quality of the respective foods was in all cases as nearly alike as circumstances would allow, yet the actual stocks used were different for the three seasons.

Swine.—The most prolific of any of our domesticated animals, bringing forth twice a year from six to twelve at a time, one would suppose them likely to be the favourite means of converting food into flesh; and their fecundity has always struck amateurs in farming in connexion with their comparative neglect for this purpose. Their omnivorous character is another ground of the confidence

with which they might be regarded as the cheapest and most profitable meat-makers of the farm. The fact, however, is, that meat-making is strictly a manufacture. It is no more necessarily an advantage to the meat-maker that his machine has the power of multiplying rapidly, than it would be to a paper-maker to be overstocked with engines, or to a cloth-worker to have more looms upon his premises than his means of working them required.

Without referring to the fecundity of the animal, there are, however, some reasons why in fattening pigs more profit might be expected than in fattening oxen or sheep. One is, that the carcase of the pig includes the head—so much additional weight—which in the case of ox or sheep is part of the offal. Another is, that the pig is a feeder on all manner of vegetable and animal refuse—extracting nourishment even from the dungyard when half-digested matter has passed through other animals, and it is useful therefore as a scavenger and utilizer of waste food.

Among several breeds of swine may be named the Berkshire, a black or black-and-white breed of medium size, hardy, of good quality, and fattening early; the Essex, a smaller black breed, in some of its varieties crossed with the Neapolitan, and of remarkable quality; the Cumberland, a small white breed of equal quality; the Suffolk, of which an account is given by Mr. Stearn in previous pages (see Index); the Yorkshire, a large white breed. In choosing a sort for the farm you may be guided wholly by the market demand in your neighbourhood; for the pig is dependent on soil or climate less than any other of our domesticated animals. Fed in yards and sties on food provided for it, any sort may be selected for breeding, according to the demand either for bacon or for pork that exists.

We add Professor Simonds' table of the dentition of the pig as indicative of age:—

Dentition of the Pig.

	At birth.	One Month.	Three Months.	Nine Months.	Twelve Months.	Eighteen Months.
Fœtal { incisors	4	4	4	...	...	...
{ tusks	4	4	4	...	...	...
Temporary incisors	...	4 central	8 central & lateral	8 central & lateral	4 lateral	...
Permanent incisors	...	...	...	4 corner	8 central & corner	12 central lateral, & corner.
Permanent tusks	...	...	...	4 (cutting)	4	4
Total in both jaws	8	12	16	16	16	16

On estimating the weight of fat cattle, sheep, and pigs, we add the following on the estimation of weight by measurement in the case of cattle:—

The principle of the process consists in ascertaining the solid contents of the carcase, considering it as a cylinder, and multiplying each cubic foot it contains by such a fractional number as represents ordinarily the weight in imperial stones, which a cubic foot of the living animal so measured weighs in beef. But this fractional number must obviously vary materially according to the condition of the animal: a very fat animal will yield more beef per cubic foot of its living bulk than a very lean one. When the multiplier, however, is selected according to the circumstance of the case, a very near estimate may be generally arrived at. And such a method as is thus obtained is of much money worth to the practical farmer and to unpractised salesmen. In very many instances practical farmers do, in selling or buying stock, make it just an act of getting as much out of those with whom they are dealing as they can. They bid as low, or ask as high a figure as power of face permits, with regard to the real value of the article on deal. There can be no doubt that not only waste of time is thus occasioned, but that a less successful trade results; for men who see in their customers the aim not so much to give or get the real value of the article which they wish to buy or sell, as just to get as much or give as little as the other will allow, are sure in the long run to get the better of the bargain. That this measurement of the living animal is a great assistance to the judgment, there can be little doubt. We have, before now, in valuing for an outgoing tenant, sold by it as much as nearly 400*l.* worth of fat stock at one deal, without two minutes' talk with the dealer. An hour's examination was required on our side with the eye and hand, and measuring tape, and a quarter of an hour's examination was needed by him, with his note-book in his hand, and, on comparing figures, our respective estimates were within less than one per cent. of one another. In this case the stock were in average marketable condition, and they were an even lot of one breed, all of course tending to the accuracy of the results of measurement. And the dealer was known to be a trustworthy, honourable man.

The following is the rule:—To find the length of the animal, measure the distance between two upright lines, one of which represents in position the general outline of the hind quarters, and is therefore somewhat beyond the insertion of the tail; and the other passes through a point on the front of the shoulder, about one quarter or one third of the way down the sloping front. To find the girth of the animal, measure it behind the shoulder where it is smallest, and take it tightly when there is any quantity of coarse hair on the skin.

To find the weight from these two measurements, multiply the girth (in feet and inches) by itself, and the product by the length, and that by the fraction $\cdot 24$ for ordinarily fat animals, perhaps less than this or $\cdot 22$ for half-fat beasts, or by as much as $\cdot 275$ for extraordinarily fat animals, the result will be the carcase weight of the animal in imperial stones. The weight of the carcase is to the live weight of an animal as 1 to 2, or a little more than 1 to 2, in fat cattle; as 8 to 14 or thereabouts in fat sheep; as 3 to 4, or more, in the case of well-fattened pigs. But these proportions vary according to the condition and breed of the animal.

Before leaving the live stock of the farm, I may refer to some of the results of Mr. Lawes' experiments in feeding cattle, sheep, and pigs respectively—quoting from his reports in the *Journal of the Royal Agricultural Society of England*.

On the relation of Food and Increase.—(a) Fattening oxen, fed liberally upon good food, composed of a moderate proportion of cake or corn, some hay or straw chaff, with roots or other succulent food, and well-managed, will, on the average, consume twelve to thirteen lbs. of the dry substance of such mixed food per 100 lbs. live-weight, per week; and should give one lb. of increase for twelve to thirteen lbs. dry substance so consumed.

(b) Sheep fattening under somewhat similar circumstances (but with a less proportion of hay or straw) will consume about fifteen lbs. of the dry substance of the mixed foods per 100 lbs. live-weight, per week; and should yield, over a considerable period of time, one part of increase in live-weight for about nine parts of the dry substance of their food. If the food be of good quality, oxen and sheep may give a maximum increase even provided the food contain as much as five parts of total non-nitrogenous* to one of nitrogenous compounds.

(c) Pigs, fed liberally upon food composed chiefly of corn, will consume from twenty-six to thirty lbs. per 100 lbs. live-weight, per week, of the dry substance of such food. They should yield one part of increase in live-weight for four to five parts of the dry substance of the food. They may give a maximum amount of increase for a given amount of dry substance of such food, if it contain as much as five or even six parts of total non-nitrogenous to one of nitrogenous compounds.

(d) Well-bred and moderately fattened oxen should yield fifty-

* The cereal grains contain on the average rather more than six parts of total non-nitrogenous to one of nitrogenous compounds; and the leguminous seeds often not much more than two parts to one. Oilcakes and foreign corn contain rather more than six-sevenths, and home-grown corn, bay, &c., rather less than six-sevenths, of their weight, of "dry substance." Common turnips generally contain about one-twelfth; swedes about one-ninth; mangolds about one-eighth; and potatoes about one fourth, of their weight of "dry substance."

eight to sixty per cent. carcase in fasted live-weight; excessively fat oxen may yield from sixty-five to seventy per cent. Moderately fattened sheep (shorn) should yield about fifty-eight per cent. carcase in fasted live-weight; excessively fat sheep may yield sixty-four per cent., or more. Moderately fat pigs, killed for fresh pork, should yield (including head and feet) about eighty to eighty-two per cent. carcase in fasted live-weight; large, well-fattened pigs, fed for curing, will yield a considerably higher proportion. In each of the three descriptions of animal, the proportion will, however, vary much according to breed, age, and condition.

(e) Of the *increase* over the final six months of liberal feeding, of moderately fat (one and a quarter to one and a half year old) sheep, sixty-five to seventy per cent. may be reckoned as saleable carcase. Of the *increase* over the final six months of liberal feeding, of very fat (one and three quarters to two years old) sheep, seventy-five to eighty per cent. may be reckoned as saleable carcase. Of the *increase* over the final two or three months of liberal feeding of moderately fat pigs, about ninety per cent. (including head and feet) may be reckoned as saleable carcase.

(f) Sheep, fattening for the butcher on a good mixed diet, should give about nine parts dry increase—consisting of about eight parts fat, 0·8 to 0·9 part nitrogenous substance, and about 0·2 part mineral matter—for 100 parts total dry substance consumed. More than ninety parts of the consumed dry substance are, therefore, expired, perspired, or voided.

(g) Pigs, liberally fed on fattening food, should give fifteen to eighteen parts of dry increase—consisting of thirteen to sixteen parts fat, one and a half to two parts nitrogenous substance, and less than 0·2 part mineral matter—for 100 parts total dry substance consumed. There will, therefore, be eighty-two to eighty-five parts of the consumed dry substance expired, perspired, or voided.

II.—FIELD WORK.

Wheat sowing.—The conclusion of autumn wheat-sowing, on which enough has been already said (see Index), should take place this month.

In reference to the question of seed, it is impossible to give any rule upon a subject which is so manifestly dependent on circumstances. All will agree that a certain loss of seed occurs every year from destruction by birds, water and frost, wireworm, &c.; and it will also be agreed that these causes must be much more influential in some localities than in others; add to this the fact that some soils will cause a seed to throw out 20 heads, while others fail of producing five, and we can easily see how it is that some farmers, speaking from experience, recommend three bushels

per acre, whilst others, on equally unanswerable grounds, have asserted three pecks to be more than enough. Our general practice has been to sow about $1\frac{1}{2}$ bushel per acre drilled in rows 9 inches apart: but we have grown the crop from less than 2 pecks per acre with very fair results. It is obviously of importance that each should in this matter determine for himself what under his circumstances it is best to do; for while the evils of thick sowing include a serious waste of valuable food, those of *thin* (using the term as being on the other side of what is *right*), equally tend to our loss by inducing a late harvest, a tendency to mildew, not to speak of a want of plant.

As regards the preparation of the land for this crop, the wheat plant likes a firm seed-bed; it prefers a stiff soil, and is thus best sown on a stale furrow when the land is wettish, and it should be sown by drill or dibble, not broadcast. If sown on a firm seed-bed on drained land, it is not likely that the crop will suffer from being thrown out by the frost, as it often is on wet land where there is a distinct floor of hardened subsoil covered by a loose layer of wet earth.

It is advisable on all clay soils, even where the land is drained, to clean out water-furrows on the surface, and see that there is free exit to the ditch for any surface water that may collect during winter.

Turnips.—Where it is the practice to harvest this crop, it should be done in November. It facilitates the work, for swedes and turnips have generally a firmer hold of the ground than mangold wurzel, if the rows be undercut by a broad-shared plough, or a plough whose share has had an extra sword-shaped flange or wing welded on to it. This, if the tool be held carefully as it is drawn along by a single horse, will cut the tap-root of the turnip without overturning the root, and will thus render the work of lifting it the easier. When it is desirable to do two rows at once, this may be easily managed by using the horse-hoe for the purpose (p. 385), shifting the hinder teeth, so that the blades shall project outwards, or if it be necessary, first getting them fashioned expressly to suit the work of undercutting the row on either side of them as the tool is drawn down the interval.

The work of harvesting the turnips differs generally from that of the mangold crop, in that the former is generally consumed for the most part on the land. In this case the crop, or so much of it as is left for sheep to eat upon the ground, is, after the tops have been cut off, thrown into heaps, about one for every fold, and then piled up conically and covered with earth enough to keep the frost out of them. It is often the case that one-third or one-half of the crop is carried home for consumption in yards. In that case the rows to be removed, every alternate six, or thereabouts, are pulled first,

and topped and tailed and filled into carts before the remainder is lifted and thrown into heaps.

Mangolds, Carrots, Parsnips, and Potatoes.—The necessary work of digging, pulling, and harvesting these crops must be finished as early in November as possible.

Ploughing stubbles before winter should be prosecuted with diligence as long as the land is dry. It is the advantage of steam-power for cultivation that a larger portion of this work can be done in the dry autumn months earlier in the season. Especially on clay soils is this work advantageous. Such soils are a fuller storehouse of the food of plants than any other—what is wanted is a key which shall unlock these stores of wealth. Water is the key by which such stores are made accessible in other cases—or rather it is the messenger or warehouseman who enters and dispenses or administers the contents. On light and well-drained soils it has free ingress and egress, and performs its office perfectly. But on clays it cannot enter; in fact, its influence there often is to shut the door the firmer against attempts at entrance. What is wanted is some master key, by which admission may be obtained—steam tillage accompanying land drainage is we firmly believe such a master key, and by its influence on clay lands they are to receive an immense increment to their productive powers. To plough lands when wet, even though it be before winter, is turning the key upon the stores of food clay lands contain, and locking them up the firmer from the roots of plants.—The ploughing of lea land for oats or beans to be sown in the following February and March should be completed as soon as possible. It is well to use the skim coulter, and so provide for the complete burial of the green surface.

Gorse when cultivated as food for cattle, will yield a first cutting in November. It is cut with a small hook, somewhat resembling a reaping hook, but broader and more circular in the blade. A labourer accustomed to this work will speedily hew down whatever quantity of gorse may be required. A hundred faggots are considered a good day's work, supposing the furze to be strong and from $2\frac{1}{2}$ to 3 feet high. The usual price for cutting is about *5d.* to *6d.* per score. Each faggot weighs from 15 to 20 lbs.; and when bruised it takes 2 or $2\frac{1}{2}$ faggots to make a bushel. The quantity of this description of green food which may be obtained from an acre will vary according to the thickness, height, and quality of the furze; 2000 faggots may be reckoned an average crop, and will yield 800 to 1000 bushels of the crushed food. It is crushed either with a machine, half chaff-cutter, half mill, for the purpose, or simply with mallet and block.

The food is usefully given to all kinds of stock. It is not to be expected, of course, that horses fed on green food can perform the same amount of work as others that are fed on such nutritious sub-

stances as hay and corn ; but for the common purposes of husbandry, they can be kept in working order when partially fed on gorse, and have coats as soft and silky as if they had been fed on carrots, and kept in a warm stable. One great advantage to be derived from the feeding with gorse is that it becomes fit for use at the time the horses are housed in autumn, and by occasionally using it during winter, it enables the farmer to dispense with a larger proportion of hay until the spring, when the horses are harder worked, and, of course, require to be better fed. For milch cows there is not a better description of winter food, or one that is more relished by them than gorse after it has been properly bruised.

The average quantity given to working cattle is about $2\frac{1}{2}$ bushels a day, with straw. On this meagre fare, it is astonishing how much labour they will perform. A moderate-sized cow will consume from 3 to $3\frac{1}{2}$ bushels a day ; but 2 or $2\frac{1}{2}$ bushels, with a few turnips and a few pounds of hay, may be considered a fair allowance.

The Hop-Garden.—On farms where hops are grown the work in October and November includes stripping off and tying up the haulms from the hop-poles after the picking, and stacking away the poles ; in cutting larches for hop-poles, cleaning out ditches in plantations, commencing winter's draining, in all instances not less than four feet deep, and throwing and sorting hop-poles. Teams are employed in carting off poles from grubbed hop-grounds, in carrying the hop haulm to our fold-yards, and in ploughing and autumn sowing of tares and wheat.

Fences.—This is the first month for hedging and ditching. After you have once brought your fences into good order, which should always be effected within the first three years of a lease, the best way is to divide the length of hedging into eight to twelve parts, and to make it a rule to re-make one portion every year afterwards ; by which means the whole will always be kept in good order. The best method for all old hedges, consisting not wholly of white thorn, is the plashing (pleaching), in which, by leaving as many hedge-stakes alive as possible, and by laying down much growing wood, the hedge is constantly impenetrable.

Water Meadows.—In this month you may begin to water the meadows and pastures, wherever it can be done ; and be assured that no improvement will pay better : a winter's watering will answer in the hay, fully equal to a common manuring of the best stuff you can lay on the land ; and the expense, in some situations, is trifling.

Woods.—Now, too, begins the business of wood-cutting. In some parts of the kingdom this is a profitable part of husbandry ; but, in many others, it pays very indifferent returns. If there is a long carriage to the wood, it rarely answers well enough to induce a spirited farmer to apply his attention and money to it : arable

and grass land will pay better. But, if it is expedient to keep woods, it is worth attention to apply them to the best use. Hop-poles, hoop-stuff, hurdles, short faggots, long ones, bushes, stakes, and edders : each of these articles is, in some places, more profitable than any of the rest ; and, I believe, on an average, those will be found most beneficial, for which the purchasers come to take them away. The carriage of so cheap and bulky a commodity as wood is a very great deduction from the product.

Grass fields should be furrowed and ditched, if necessary, this month. Cattle should be taken from them into yards. The ewe flock may be thinly scattered on dry pastures, but otherwise no live stock should be allowed to poach them during winter.

The commencement of a hard frost should be selected for cutting ant hills, as that will destroy such ants as may be exposed to its influence. At such a time let a labourer with a common spade make a deep cross over the top of an ant-hill, and then by horizontal cuts made level with the surface of the ground, turn the four quarters of the hill bottom upwards ; then cut the nests of ants from the bed on which the hill had stood, as well as from the four quarters of it, and spread them about. Near the end of the winter the grassy part which remains of the dissected hills may be returned to their former places, in such a manner as to produce a level surface.

Odds and ends.—The following is a picture of farm management in November, on the Hampshire farm, already often quoted in these pages :—

Nov. 20.—We have now finished wheat-sowing, with the exception of about twelve acres, which we intend to sow as soon as the swedes and turnips are fed off. We have been also engaged in carting loamy earth, to be spread about six inches in thickness over the bottom of the farm-yard, which is our regular practice after removing the dung ; there to remain until the next autumn, when it will either be removed with the dung and carted on to the leas for wheat, or else carted separate from the dung on to the pasture land, for which it proves an excellent dressing, with a slight quantity of superphosphate of lime and Peruvian guano, applied just previous to spreading the earth. Some of our men have been employed in planting young thorn plants, and cutting and making fences for the protection of recently-planted quicks. We find a good and cheap fence can be made of good stout wire, strained from posts placed quite firm in the land, about fifty yards apart. At intervals of three yards stout stakes are driven into the land, to which the wires are fastened by staples : a sheep and cow fence requires five wires, the top wire being about three feet from the ground, &c. Our stock of sheep on the sand farm consists of 200 Southdown ewes to bring lambs, which are folded every day on Italian rye-grass and one change on to dry pasture, and forty dry ewes fattening on turnips,

Dutch clover hay, &c., and half a pound linseed cake each per day. Fifteen ewes have dropped their lambs, and, from appearances, we expect 100 lambs by the 14th of December. Our stock of sheep on the clay farm consists of 170 horned Somerset ewes, about sixty of them dropped their lambs last October, which, with the ewes, are now feeding on cut swedes, and Dutch clover hay, the lambs having linseed cake and cracked peas in addition. We have forty horned ewes also, dry, and fattening on cut swedes, hay, and half a pound linseed cake each per day.

The women have been employed preparing and stacking swedes in readiness for the cutter, gathering acorns for the pigs, assisting the men spreading manure, and forking out grass from the fallows.

III.—THE LIVE STOCK OF THE FARM.

The Stable.—As winter draws on and days shorten, the winter ration may be substituted for that of the laborious autumn seed-time: the supply of oats may be shortened, and straw substituted for hay in the chaff. Tables are given elsewhere of winter feeding. (See Index.)

On Wintering Store Cattle.—This was the subject of a capital practical paper by Mr. Ford, of Rushton, near Blandford, lately (Nov. 1861), read before the Blandford Farmers' Club. The following is the substance of the advice he gives:—

“It is acknowledged by all practical men, that it is advantageous to keep as much stock as we can possibly accommodate; and it especially behoves farmers to adopt the best and most economical system of wintering their flocks of sheep, as they are one of the mainstays of farms, especially of very poor farms.

“I winter my sheep on turnip land (in favourable weather), and let them lie as regular over the land as I can, for the benefit of the succeeding barley or oat crop, giving them straw with a liberal allowance of roots, and hay once a day, until my ewes begin to lamb. I then give them hay twice a day, and roots as before; in bad weather taking them off the land at night, and putting them in some sheltered situation near, knowing that the health of all animals depends much on protection from the inclemency of the weather.

“I believe that lambing well much depends on the regularity of feeding through the winter. On many occasions I have remarked how much food is wasted by ill-bred animals of every kind, especially by those that have bad constitutions, and by those also that have an inaptitude to fatten; whilst at the same time I have also observed, that a well-bred animal with good constitution has been damaged, or ruined for want of proper food and general good management. How necessary, then, is it, that the farmer should attend

to his matters and keep his eye daily on his flock, and also upon his shepherd and upon his herdsman.

"Frequently has it occurred to me that we suffer great injury by neglecting our flocks, even for the shortest period; a day or two's neglect may require weeks of reparation.

"The same principles apply to cow stock. It is necessary that they should have a yard and a comfortable well-strawed shed to lie in, and it is essential that the shed should lie open to the south. You will find that in good and well-littered lodging-places the stock will thrive much faster than they will do even with a greater quantity of food consumed in discomfort and in undue exposure to the weather. I have often seen stock in winter 'stuck' up under a hedge with unhealthy coats, especially in damp situations, with food apparently plenteous; but owing to exposure to the rigours of winter they have been so poor in the spring as to be worth less money than they were worth in the preceding autumn.

"I am fully persuaded that there is more profit arising from good feeding and nursing stock well, than there is from keeping them in the open fields the greater part of the winter, or in wintering them with straw alone (a most cruel way) in the straw yard. I feed a quantity of stock with straw, to which is added a small quantity of roots and cake. The winter months being the proper time for threshing barley especially, and also a good portion of other crops, we can always afford to give the stock plenty of straw for food, and for bedding, to make them comfortable.

"You will find that by giving store stock in the straw-yard one bushel of pulped roots (which is inexpensive) mixed with straw chaff or husks of corn, and two and a half pounds of linseed cake per day, or four pounds of green German rape-cake, the cost would be for cake about 3*d.* per day per head. There are different opinions respecting the most economical cake. I am inclined to give the preference to linseed cake; but if the manure from the rape cake is equal to the manure from the linseed cake, the rape cake may possibly be the more economical cake of the two, as its cost is less.

"It is highly necessary that we should be very particular as to what stuffs we purchase for feeding purposes, as there are so many advertised as being something extraordinary."

Mr. Ford then refers to Thorley's cattle condiment, as having failed, in his case, to be of any service. He proceeds:—

"A judicious outlay of money and a proper application of the food purchased will always well repay us. One thing is certain, that an animal starved in winter will require half a summer to get it into store order; but an animal well wintered is half summered; the converse also being true, viz., that a well-summered animal is half wintered. This then shows us the necessity of proper feeding, and also of general good management, and regularity of feeding."

Oilcakes as Food.—To the above remarks we add an extract on a subject to which Mr. Ford refers, from another lecture given during the previous month before another Dorsetshire farmers' club, by Mr. W. C. Spooner, of Southampton. Mr. Spooner's remarks related principally to the subject of winter food for a breeding flock, and in the course of it he compared linseed cake with rape cake. The experience of Mr. Lawrence, of Cirencester, has been already quoted (see page 530) ; and his method of avoiding the risk attending the use of the latter has been described. The following sentences compare it and other cakes in point of composition merely.

Rape cake has 23 per cent. of starch, gum, and sugar, but of albumen 29 per cent. or nearly 2 per cent. more than linseed cake, and about the same of fatty matter. But notwithstanding this, we know from a number of experiments that rape cake will not put on the same amount of fat as linseed cake, however desirable it may be for young animals at an early stage, given in the straw-yard, and for milch cows, the cost being considerably less. There are some cakes, however, which contain a much larger amount of albuminous matter. Poppy-cake has 35 per cent. as compared with 27 in linseed-cake, but only 5 per cent. of oil ; and this points strongly to the fact, which has been proved, that this is excellent food for lambs or ewes for the production of milk. The decorticated cotton cake is still richer in flesh-making properties, also in oil ; which may be accounted for in this way, that it contains less woody fibre. As I have observed, however valuable rape cake may be for young animals, containing as it does so large a proportion of flesh-making properties, yet in the latter stages of fattening it does not produce the result that may be expected from the increased quantity that can be given for the same money, as compared with linseed cake. The same observation will apply, in a somewhat less measure, even to decorticated cotton cake, which however contains 16 per cent. of oil, and a very large quantity of albumen. This may be explained by the fact that what can readily be digested by one animal is not suitable to others. The taste and digestibleness of food as well as its mere composition affect its influence in the feeding process. It has been found advantageous to mix various kinds of food together, and whenever a change is made it should be gradual, whether from grass to roots, from turnips to swedes, or from one kind of cake to another ; and thus decorticated cotton cake has been found to produce greater results if given with linseed cake than if given alone. One thing should be borne in mind, that its value is greater for the manure heap than linseed cake, because so large a portion of albuminous matter passes through the animals. The same remark also applies to rape cake, which can be bought at a cheaper rate than linseed cake.

Cattle Condiments.—Mr. Spooner has also given his opinion on

concentrated cattle foods. He says, "When horses get old their teeth often get out of order and become sharp and irregular at the edges so as to wound the gums; or perhaps a molar tooth gets broken off so that its antagonist becomes long and projecting, and in time prevents its neighbours from doing their duty. Whilst the old man under such circumstances can resort to the dentist, or to soup, or to the sausage machine, the old horse is expected to masticate as well as ever. Here then is a case for the cattle food; and hence the marvels it effects in such a case by supplying nourishment in the form of meal, doing that for the old horse that he could not do for himself. Again, when a horse gets old his digestive organs frequently become weaker, and advantage is often derived from giving him tonics and cordials. Although the best tonics are bitter, hot, and disagreeable, such as gentian, ginger, Peruvian bark, or preparations of iron or copper, yet fortunately for the compounders of cattle food there are others, though less potent, that are by no means disagreeable, such as liquorice, cascarilla bark, aniseed, caraways, and a few others. So that by giving meal thus sweetened and slightly flavoured with salt, the digestion of the old horse is stimulated and coaxed, and his condition improves. It is true that this effect can be produced as well by giving the animal his food properly ground or in the form of meal, and if need be assisting him occasionally with some tonics or cordials; but there would be nothing *mysterious* in this, and John Bull is fond of the marvellous."

Mr. Lawes also has referred to the subject of concentrated cattle food and cattle condiments. He says, in an article on the subject in the *Agricultural Society's Journal*:—

"In common with other agriculturists I have been invited, by advertisements in the papers, by placards on the walls, and by circulars containing numerous testimonials from distinguished persons, to employ certain manufactured foods in the feeding of the animals on my farm. These foods frequently cost from 40s. to 50s. per cwt. (now about 35s. per cwt.) Taking the published average prices for a recent six weeks, one cwt. of the following stock foods would cost as under:—

						s.	d.
1 cwt.	Barley	.	.	.	.	8	4
"	Oats	.	.	.	.	9	2
"	Beans	.	.	.	.	9	4
"	Peas	.	.	.	.	9	6
"	Lentils	.	.	.	.	10	0
"	Oilcake	.	.	.	.	10	0
"	Linseed	.	.	.	.	16	6
"	Hay	.	.	.	.	4	0

"The manufactured foods thus cost, weight for weight, four or five times as much as the most nutritive of the ordinary stock foods

on our farms. Very undeniable evidence of the superiority of the former should therefore be required, to induce the farmer extensively to employ them."

He then gives the composition of one of these foods, as ascertained in his laboratory. The figures stand as follows:—

Water	.	.	.	.	.	.	12·86
Nitrogenous substance	.	.	.	.	.	.	15·51
Fatty matter	.	.	.	.	.	.	6·22
Starch, sugar, &c.	.	.	.	.	.	.	55·97
Woody fibre	.	.	.	.	.	.	5·50
Mineral matter	.	.	.	.	.	.	3·94
							100·00

"Independently of the slight colouring with turmeric, and flavouring with cumin, anise, or other of the stimulating and carminative seeds used in cattle medicine, which these foods frequently exhibit, the constituents as here stated could be supplied by a mixture of barley meal with some of the leguminous seeds enumerated, and oilcake or linseed. Such a mixture, according to the prices quoted, could be prepared for about one-fourth the price of the manufactured cattle food."

Mr. Lawes then refers to the general theory of nutrition, and to his own valuable experiments on the subject reported in previous numbers of the *Agricultural Society's Journal*. To the question why concentrated foods cannot be used in the production of animal growth as concentrated manures are used in the production of vegetable growth, he replies:—

"The answer is plain. In using the concentrated manufactured manure, containing a certain amount of nitrogen or phosphates, for example, the bulk of the crop is obtained from other sources—such as the atmosphere and water, not supplied by the farmer's hand—the natural constituents existing in his soil, and the residue from previous manures and crops. The application of a small quantity of ammonia and mineral matter will often yield as great an increase of vegetable produce as if twenty or thirty times the weight of farm-yard dung had been employed. This is not to be wondered at when it is considered that by far the greater bulk of the dung consists of water and other constituents which the plant can obtain either from the air or the soil. We thus get, by the use of concentrated manures, a much greater weight of increased produce than there was of manure employed. The case is very different in the supply of food to our stock. The quantity of the constituents returned in the solid and liquid excrements, and in the increase of the animal, must invariably be very much less than was contained in the food consumed. No concentration of constituents, nor any

amount of supply of some only, of those required for the respiration, the perspiration, the excrements, and the increase, can enable the animal to obtain a particle of what is requisite for these, from any other source than his food."

And he concludes thus :—

"From all that has been said, it will be clear that these newly-manufactured foods cannot substitute any of the necessary constituents contained in our ordinary stock foods any further than they themselves supply them. So far as the mere supply of alimentary constituents is concerned, a mixture of linseed or oilcake, and corn-meal, can provide these at one-fourth to one-fifth the cost of the specially-made artificial foods. Such foods cannot therefore be relied upon as staple articles. The virtues which they really do possess over and above those which could be secured at one-fourth to one-fifth the price are confined, therefore, to the action on the health and digestion of the animals of the small amount of stimulating and carminative seeds which they contain. In fact, so far they are sauce or medicine rather than food. As such they are likely rather to increase than to diminish the appetite for further nutriment."

Mr. Lawes' report concludes with the details of an experiment in pig-feeding, made with a view to ascertain the effect of using the "cattle food" according to the directions of its salesmen.

The results were so nearly identical in the two cases, that the difference cannot be fairly attributed to any intrinsic difference in the character of the food. And it was clear that nothing was gained by adding to the barley-meal and bran one-fifth of its weight of food, costing about five times as much money.

No doubt, the various makers of cattle condiment use the very best foods they can obtain in the manufacture—the best grain and pulse, and, according to a recent trial, the best oilcake; and the best medicinal compounds as flavourers. But these medicinal compounds cannot be a very large proportion of the whole, for if they were, their medicinal influence would be excessive; the whole of the large remainder then is paid for by the farmer who buys the food, at the rate of 35*l.* or 40*l.* a ton (whatever the charge may be), whereas he can get them in the market for less than one-third that amount. That is the point to which we would fix his attention. And not only this, but if he spends 35*l.* on a ton of the artificial food, he will obtain at most 2*l.* or 3*l.* worth of extra value in manure; whereas if he spends it on three tons of oilcake he will, as Mr. Lawes explains above, get from 6*l.* to 10*l.* returned in the manure derived from its consumption, besides the beef or mutton which in either case he may make.

We recommend our readers, therefore, to try oatmeal and linseed meal, and beans and peas, and mix them for themselves; and if their

cattle want a "tonic stimulant" let them consult their veterinary surgeon how best to medicate the cattle food thus home made. They will find it a wonderful saving to their pockets.

Besides numerous cakes, meals, grains, and other foods already named (see Index), as food for cattle, we may add the recent use, in large quantities, of locust pods—an importation from the Mediterranean—as a sweet and wholesome provender for sheep and cattle. And Mr. Hudson, of Caithness, has called attention of late years to the value of wheat, as a remarkably cheap and economical food whenever it falls, as it occasionally has, to 5s. a bushel in the market. He says, writing at such a time :—

"We now grow all the barley we can, and one-third fewer acres of wheat than we have done for several years past. The very low price of wheat has induced us to feed our cattle upon wheat on a large scale, it being cheaper than linseed cake. I never remember so large a quantity of wheat consumed by cattle as there has been during this season, and a great deal is being made into malt instead of barley; surely this must tell upon prices by-and-bye; and the farmers intend to keep a large quantity in stock, to see the result of another harvest."

Theory of Cattle Feeding.—It has not been attempted in this work to give such detailed explanations of agricultural experience in scientific terms, as are generally referred to by the farmer under the common name of "theory;" but the use of such terms in past pages on cattle food makes it necessary to refer to the explanation which the chemist gives of the process of cattle feeding. The question—What is the value of a ton of turnips?—is one to which half a dozen men will give half a dozen answers. Its power to produce meat, on which its value depends, is due not only to its composition, which varies in the half dozen different cases, but on the character of the machines through which it is passed, and on the skill with which the process is conducted.

I suppose that two lots of rags of equal quality may be served out to two paper-makers, and the one shall make more profit of them than the other, owing to the two last considerations. But if the rags are of different quality to begin with, the difference in the result would be greater still. And this is the position of the farmer:—The food he grows differs wonderfully in its quality, according to soil and climate; the machines he uses differ exceedingly in their character; the judgment and skill he employs vary between the extremes of folly and wisdom. No wonder then that we have not yet agreed as to what is the value of a ton of turnips, or of any other article of food. Mr. Mechi tells us in the south that no profit is to be made of feeding meat, that the meat manufacture is, in fact, as regards the farmer, useful merely as a manufacture of manure. There is many a farmer, both south and north, who knows better.

In order to the attainment of their experience, probably the first particular rule is to have special regard to the capabilities of your machines for converting the raw material—the food—which you are to manufacture into flesh.

It is only a well-bred animal which can make the full use of liberal feeding. You must be acquainted with the needs and the powers of the breeds you feed, as well as with the general rules and truths of animal nutrition. And now let us consider what those general rules and truths are. It is only within the past few years that the theory of food in relation to growth has been fully developed, and growth has been recognised as a simple building up and aggregation of the materials which the food contains.

The chemist divides the constituents of food into three great classes. The first two include all that may be burned away; the incombustible part—the ash—is the third. This ash is soluble or insoluble; the latter part consists chiefly of phosphoric acid and lime, which, constituting two-thirds of the bones of animals, is called bone earth. This earthy part of the ash thus supplies the animal with the materials for the formation of its bony skeleton. The saline soluble part of the ash of food is made up chiefly of common salt and phosphate of soda, which two combinations enter largely into the composition of blood. It also contains salts of potash, which abound in the juices of flesh. The saline matters thus supply the blood, the flesh, and various animal juices with their necessary mineral constituents.

The organic part of food which burns away is made up of a number of organic substances, as starch, gum, sugar, fibre, albumen, &c., and these may be grouped into two classes—the first including constituents rich in nitrogen, and the second constituents free from nitrogen.

The nitrogenized ingredients include albumen, gluten, casein, legumin—substances nearly identical with each other. The second class includes oily matters, starch, sugar, gum, pecten—a jelly-like substance found in carrots, mangold wurzel, turnips, and other roots—and cellular fibre. The nitrogenized compounds generally contain about 16 per cent. of nitrogen and small quantities of sulphur, or phosphorus, or both; and are hardly, except in this last particular, distinguishable from each other. They are all made up of a substance, protein, and this sulphur or phosphorus, and so they are called protein compounds.

These protein compounds are necessary to the food of animals. Dogs fed on starch alone will die. A sheep fed with food perfectly free from protein compounds died on the 20th day. The practical value of oilcake, beans, grain, &c., as compared with foods poorer in nitrogenous matter, proves the assertion that protein compounds are needed. The non-nitrogenous compounds are also ne-

cessary. A goose was fed on albumen—white of egg—without the addition of any other food, and died in about six weeks, having lost a great deal of weight. All classes of ingredients are needed to make a perfect food.

The non-nitrogenous compounds contain large quantities of carbon, and their use is to burn as fuel in the lungs, and so to maintain the heat of the body; or to be placed as fat in the fatty tissues of the growing body; or to be converted into fat and placed there. The protein compounds, on the other hand, which are almost identical in composition with flesh, go to build up the flesh of the animal. You have in food, as stated by Dr. Voelcker:—

(1) The earthy substances, phosphates of lime and other bone materials. The saline substances—chlorides of sodium and potassium, sulphate and phosphate of potash and soda, and some other mineral matters occurring in food—supply the blood, juice of flesh, and various animal juices with the necessary mineral constituents. (2) Albumen, gluten, legumin, and other nitrogen-containing principles of food, furnish the animal with the materials required for the formation of blood and flesh; they are called, therefore, flesh-forming substances. (3) Fats and oily matters of the food are employed to lay on fat, or to support respiration and animal heat. Starch, sugar, gum, and a few other non-nitrogenized substances, consisting of carbon, hydrogen, and oxygen, are used to support respiration—(hence they are called elements of respiration)—or they produce fat when given in excess. Starch, sugar, and the other elements of respiration alone cannot sustain the animal body. Albumen, gluten, or any other albuminous matter alone does not support the life of herbivorous animals. Animals fed upon food, deficient in earthy phosphates or bone-producing principles, grow sickly and remain weak in the bone. The healthy state of an animal can only be preserved by a mixed food which contains flesh-forming constituents as well as heat-giving principles, and earthy and saline mineral substances in proportion, determined by experience, and adapted to the different kinds of animals, or the particular purpose for which they are kept.

That, then, is the theory of growth, and the practice agrees with it. Thus: a child grows rickety, its bones are not well built and vigorous if fed perpetually on arrowroot and starch food; milk containing the phosphate of lime, its bone earth, must be supplied along with such food.

Again: food rich in albuminous matter, in protein compounds, as bean-meal, oilcake, &c., is in practice found the most productive of rapid and muscular growth. Again: food rich in oily and starchy matters is in practice found the most fattening of any sorts of food.

Again: animals exposed to cold—breathing a colder and therefore a denser air, containing more oxygen or fuel-burner per cubic

foot—animals exposed to cold, requiring therefore greater expenditure of fuel to maintain the animal heat—do not in practice prosper as if kept in warmth and dryness; most of their food goes as fuel; a great deal of their food is wasted and burned up within them.

Again: animals allowed to run about and take muscular exercise, thereby increasing the rapidity of respiration, keeping the bellows blowing at the fire within the lungs, do not in effect increase in fat or flesh so fast as when kept within bounds and hindered from running to and fro. In all these particulars, then, the experience of the farmer tallies with the theory as laid down by the chemist and animal physiologist.

The Feeding-house, whether it be yard, stall, or cattle-box, must be kept warm and dry for its occupants; their food, to which reference has been already made (see Index), must be given regularly, and its ingredients changed when they appear to pall upon the appetite, and increased in richness as the animal approaches maturity. When roots are given, they should be given to the extent of $\frac{1}{2}$ to $\frac{3}{4}$ of a cwt. daily; they are best given pulped, as already described, and mixed with meal and chaff. When straw, without roots, is given, it should be moistened with a hot and salt linseed soup. To winter store cattle on straw and water only is cruelty. In Lincolnshire, large quantities of straw are trodden down into manure by young cattle, receiving along with the straw from 4 to 6 lbs. of oilcake daily. This, on the other hand, is a wasteful process.

The proper office of straw upon a farm has of late been much discussed. A capital lecture on the subject was given lately by Mr. Blundell, of Bursledon, before a Hampshire farmers' club. He referred (1) to the straw as food:—Straw must be more valuable as a feeding material than when used for the purpose of littering the pens of animals; but to make it so it must be consumed with roots, oilcake, meal, and other feeding materials. I find dairy cows in the winter months, if fed on large quantities of roots, particularly mangolds and carrots, will refuse to eat straw almost entirely, and become very lean, but they will always eat a full portion of sweet well-harvested straw when they get a small and moderate allowance of roots, say, for an ordinary-sized cow 15 lbs. of mangold three times per day, the roots being given whole just in the state they come from the store heap. Again, calves and yearlings being fed with roots in the same way will eat a large quantity of straw, and when they have been kept under cover I have had them in first-rate condition for many years past. Also fattening beasts, when they get a fair allowance of roots, say 65 to 70 lbs. per day, with from 3 to 4 lbs. of cake or meal in admixture, they will eat straw with great avidity, and do well upon it, and make a profit. It is, however, often the case that bullocks receive 100 lbs. or upwards of roots per day, with a large quantity of cake or meal, often 10 or 12

lbs. each per day ; they will not then look at straw, and are obliged to be fed with hay ; the cost price of these quantities and kinds of food stands so high that the animals do not yield a profit.

Mr. Blundell referred, in the next place (2), to straw as litter. It is useful in affording cleanliness and health to our animals, and in forming the basis of manure for the farm. Straw can be best economized in the stable when the floor of the stable is absorbent ; hence the earth bottom to the stalls requires far less straw to keep the animals clean and healthy than the ordinary brick or stone floor ; but the best of all methods, both as regards economy of straw, the health and comfort of the horse, and the value of the manure, is the loose box, where the manure is allowed to accumulate under the animal. Straw is most economically converted into manure in those homesteads where box-feeding is the rule ; and where all the animals have the manure accumulating under them, the litter will be all quite saturated with manure. I never allow any straw to go to the yard or manure heap, whether it is dry and fresh or whether it is damp and partly decayed, without first having been under the cattle, either for the purpose of affording cleanliness to the animals, or else for the absorption of manure in the boxes. I contend that straw, to be profitably consumed, whether in the ordinary state or as chaff mixed with pulped roots, should be considered as the substitute for hay ; for whether we view hay as a crop in our farming rotation, either for sale or consumption, it is the least advantageous crop which we can grow, both as being peculiarly liable to damage in making, and on account of its bulk in increasing the cost of carriage.

(3) On the abuse of straw. I call it abuse when straw-ricks are allowed to remain rotting in the fields, from having been carelessly put together.—I call it abuse when straw is carried into an extensive farmyard in large quantities, and strewed over without reference to the number of animals required to convert it into manure. It is a common thing to see 20 or 30 tons of straw thus treated, with perhaps only two or three cows and 10 or 12 pigs in the yard to tread it down ; and it is quite needless to observe that what is called manure made in this way cannot be worth carriage to the field.—Straw is abused when sold at an unremunerative price ; how often do we see huge loads of straw drawn a distance of six or eight miles, and sold, including all attendant expenses, at 35s. or 36s. per ton ? I contend that it does not pay to sell straw at such a price, and that it would be far better to keep extra cattle and convert it at home into good manure upon the plans before alluded to.—Using straw for the purpose of thatching farm buildings is a practice which cannot be too much deprecated ; it is a great depreciation of the value of land, where large quantities of the tenant's straw produce are required to thatch the buildings.—It is an abuse of straw when given to animals without some auxiliary, as roots of some sort,

rapecake or artificial food of some kind to make feeding profitable, and to prevent actual waste.

The Dairy.—We quote from the same pen as before:—The dairy cattle should now get all the warmth and shelter the farm buildings can supply. The oldest cows being generally those which calve earliest in next year, should be dried, and these will do well on a liberal supply of oat, barley, or bean straw, with $\frac{1}{2}$ cwt. of roots given to them, half in the morning and half at night. The younger cows, which are still milked on for another month or so, should during this time get more liberal fare, hay being substituted for straw, and double the quantity of roots should be given them, or they soon become poor, and they should not be allowed to lose flesh before they come to be dry. Young heifers to calve for the first time next season should now get careful attention, as it is very desirable their growth should not be checked up to the time of milking. Good wholesome food, such as hay or straw, or both, perhaps, cut into chaff, and mixed with roots, tending more to health and good growing condition, is better than meal or cake, and less likely to produce fat, which is not desirable in young in-season heifers. Cutting dry food into chaff is much the best plan for these animals, as it prevents waste, and induces them to eat more of it, for young cattle will not, as older cows, readily consume the straw whole or uncut. And pulping roots for mixing with the chaff is most likely to ensure their economical consumption. Great attention should be paid to any cows calving now, and shelter and the best food are indispensable to their doing well. Weaning calves should be in yards; chaff and roots being their best food, the latter cut fine enough for their feeding on them readily. Should the supply of roots be insufficient on some dairy farms to give all a full quantity, the weaning calves might have one meal given of oilcake, about 1 lb. a day would be sufficient, or a pint of meal from barley or refuse wheat thrown over their chaff, with a bit of salt.

It is quite necessary that weaning calves should have warm shelter, and be put in small numbers together.

It is an old saying of men of experience, "If you have but two weaning calves on a farm, you should keep them in two places." It is certainly more conducive to health, not only on account of each getting its proper share of food, but also to hinder their breathing each other's breath, which often occasions infectious disease; for from their disposition to herd so close together, should only one be a little disordered, and the breath sour, another catching this might be subject, and often is, to a worse attack, and so infectious complaints are often increased, and become fatal.

The year's accounts of the dairy can this month be closed; and the produce of a cow, on an average, in a large dairy, has yielded, at present prices, the following amount:—

4 cwt. of cheese	£12 0 0
40 lbs. of butter, milk and whey	2 0 0
A calf	1 10 0
The keep of a store pig on sour whey	1 0 0
Total	£16 10 0

Where cows in milk receive turnips care should be taken by some such recipe as has already been described, to remove the taste from the milk before butter is made from it.

The Sheepfold.—The ram is generally removed from among the ewes in lowland districts towards the end of this month.

The practice of yard feeding of sheep was described in February. It may in general be profitably carried out.

Mr. Ruston's experience is given in another part of this volume (see Index).

Fatting sheep will receive either a fresh fold in the turnip field along with hay chaff, and a lb. of cake, or pease, or other corn, or cut turnips, in troughs in the field or yard along with corn, or, as Mr. MacLagan recommends (see page 49), pulped roots and chaff and meal mixed.

The following is the report of the present date from the Lammemoor farm :—

Nov. 24.—In high districts, such as this, grass grows little or none at this season of the year, still the pastures are tolerably fresh, and sheep continue to do well. The heather is now in perfection, and forms more than half of their food. Even the cattle, when turned out on the hill, graze as much on it as on the grass. The bathing of the sheep is now completed, having occupied us about fourteen days. Five shepherds and five boys or girls employed; the shepherds shedding the wool and the others pouring on the bath. Each man does about sixty per day. Since the bathing was completed, all the hogs have been jacketed. In a former report we expressed our conviction that jacketing was a preventive, in some measure, of sturdy or water in the head, and we now give the number of cases that occurred. We have only had seven or eight cases, and of these only three have died. No doubt this disease is more prevalent in some seasons than in others, still we believe that when the animal is kept warm, there will be less sturdy. The tups were put to the ewes on the 23rd. We allow fifty ewes to one tup. This is a small number, but from the extent of ground they range over it is unsafe to give more. To prevent the ewe hogs (which graze along with the ewes) from being tupped, a piece of coarse towelling or packing-cloth, about nine inches square, is sewed over their tails, and removed whenever the tups are taken away. The usual period of gestation is about twenty-one or twenty-two weeks,

and the tuppings season does not commence in the Highland moors till now, lest the mouths should arrive in spring before the food for them. Those hogs intended to be sold unshorn in spring, after getting a few weeks' turnips at home, have been removed to turnips taken for them in the low country. The cows are in the byres during the night, and out on the moor during the day; when in the byre they are supplied with oat-straw. The calves are getting turnips, cake, and straw. The horses are ploughing grass, carting to the storeheaps Swedish and yellow turnips. Should the weather continue favourable, we shall continue at this work for some time, also at cutting drains, building and repairing dry stone dykes, building circular stalls for sheep.

The Pigsty.—Bacon hogs will fatten as the days shorten—receiving stale meal pottage, as already described, mixed and diluted in the first stages with grains and steamed roots, but gradually becoming richer and stiffer as they reach maturity.

Porkers are treated similarly. Sows may be put to the boars this month. Their period of gestation is sixteen weeks, or thereabouts, and if put to the boar towards the end of November they will farrow towards the end of March, a very convenient period of the year.

DECEMBER.

The average weather of the month at a number of English stations is given in our usual meteorological table.

The operations of the month upon the farm may be included under *field work*, *live stock management*, and *marketing*. Besides the topics thus embraced, we must refer shortly again to the subject of steam cultivation, and conclude with remarks on *farm capital*.

I.—STEAM CULTURE.

We have to add to the discussion of this subject already conducted in these pages (see Index), remarks on the following figures, which will serve to illustrate the various methods of steam culture now in operation.

Fig. 68 is a drawing of Fowler's 12-horse-power engine, in which the various parts are recognisable—the boiler, cistern for water, platform for coal and stoker, the clip-drum beneath the

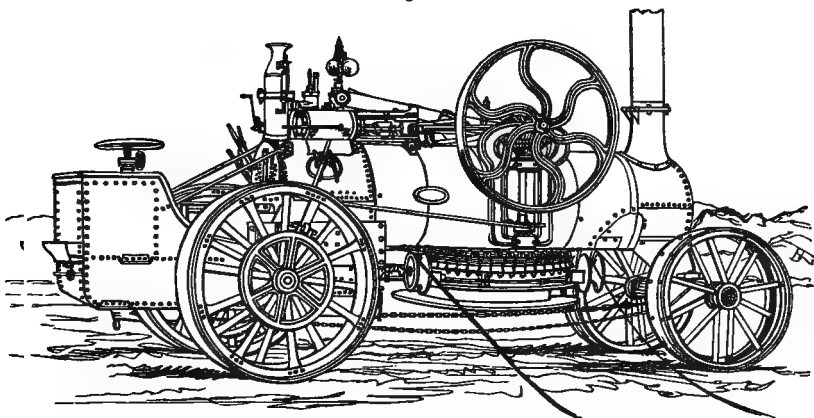
THE WEATHER OF DECEMBER.

LOCALITY.	AUTHORITY.	Mean temperature.		Highest mean temperature.	Lowest maximum heat.	Highest minimum cold.	Greatest amount of rain.		Average amount of rain.	Smallest amount of rain.		Greatest number of rainy days.		Average number of rainy days.	No. of years observations.
		inches.	degrees.				inches.	degrees.		inches.	degrees.	inches.	degrees.		
Guernsey	Dr. Hoskins, F.R.S.	45.5	41.1	50.0	59.0	51.5	40.0	26.5	4.1	1.2	7.3	18	11	25	13
Helston	Mr. M. P. Moyle ..	46.1	38.6	51.7	63.0	53.0	38.0	18.0	4.0	1.4	7.0	19	7	26	16
Exeter.....	Mr. W. H. Ellis.....	42.4	37.9	48.6	61.6	53.5	33.8	15.9	3.4	1.1	5.5	21	17	27	8
Ventnor, I. of Wight	Dr. Martin.....	43.4	36.0	50.4	59.0	50.0	40.0	21.0	2.2	0.3	4.2	14	4	22	22
Worthing, Sussex	Dr. Barker.....	41.5	36.2	48.3	57.4	49.0	35.5	17.0	2.5	0.5	4.9	16	10	21	9
Clifton, near Bristol	Mr. W. Burder, FRAS	39.7	35.0	46.7	60.6	51.3	30.9	7.1	2.2	0.6	3.9	18	12	26	8
London Royal Observatory	{ The Astronomer Royal, F. R. S. }	38.9	29.0	47.6	62.8	46.0	34.0	4.0	1.6	0.5	2.6	13	6	19	90
Bedford	Dr. Barker, F. R. A. S.	40.1	34.7	45.9	59.5	47.0	33.0	6.0	1.3	0.1	2.2	12	1	18	10
Lampeter, near Cardigan	Rev. Prof. Matthews, M. A. ...	39.4	34.4	46.5	58.0	50.2	29.6	-3.0	4.7	2.5	6.0	20	14	27	6
Norwich	Mr. W. Brooke, FRAS	38.5	32.4	45.3	61.0	43.0	31.0	1.0	1.9	0.2	4.0	13	4	22	21
Highfield-House Observatory ..	Mr. E. J. Lowe, { F. R. A. S. }	39.2	32.5	45.7	60.2	47.5	30.0	-8.0	1.9	0.5	3.9	17	11	26	51*
Oxford Observatory	Rev. R. Main, F. R. S.	40.1	34.4	47.2	59.0	50.8	32.5	0.0	1.9	0.4	3.5	14	8	21	34
Grantham	Mr. J. Jeans, F. R. A. S.	39.0	33.8	45.1	60.8	49.5	31.4	3.0	1.5	0.3	2.2	18	11	23	10
Hawarden, Chester	Dr. Moffat, F. R. A. S.	40.1	33.4	46.7	60.5	50.5	30.5	8.5	1.9	0.4	3.8	10	5	26	11
Manchester.....	Mr. G. Vernon FRAS	39.0	34.1	45.2	63.0	51.6	28.5	-3.0	2.8	0.9	5.8	18	8	28	12
Leeds	Mr. H. Denny	40.4	35.0	46.0	60.0	51.0	32.0	3.0	1.2	0.3	2.1	15	10	26	10
York	Mr. Ford.....	37.2	31.0	44.0	60.0	44.0	32.0	-4.0	1.6	0.2	3.5	12	5	21	20
Scarborough	Mr. B. Cooke	39.4	35.9	45.0	58.0	46.0	32.0	14.5	1.9	1.2	2.9	12	6	17	6
Isle of Man.....	Mr. J. Burnan, FRAS	41.7	38.0	48.9	57.1	49.1	32.0	10.3	2.8	1.1	5.8	15	11	22	8
Durham Observatory	Mr. A. Marth, FRAS	38.1	33.0	44.6	57.9	45.3	32.2	1.2	1.3	0.2	6.7	14	4	25	14
North Shields	Mr. R. Spencer	39.6	33.1	46.9	60.0	43.0	32.3	6.8	2.6	0.1	6.9	18	5	29	16
Silloth	Rev. F. Redford, FRAS	39.1	33.5	47.6	59.3	50.4	30.3	1.5	2.4	1.0	3.3	16	13	25	7

The sign (-) in the seventh column of figures shows that the readings were below Zero of Fahrenheit's thermometer.
 * Observations at Highfield House on temperature extend over fifty years, and at the Royal Observatory over ninety years.

boiler holding the wire rope, and the groove beneath on which the rope may be wound up for carriage from field to field.

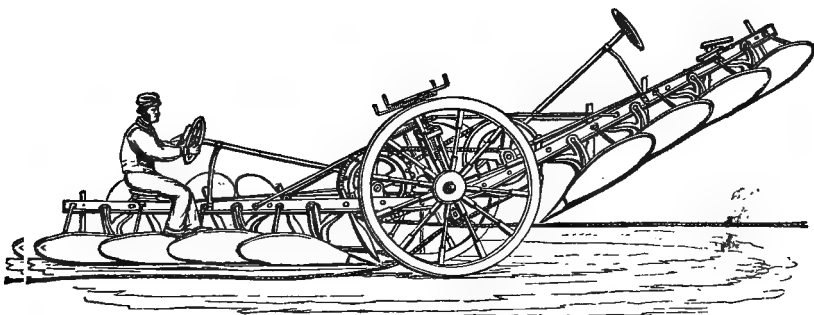
Fig. 68.



Fowler's Engine.

Fig. 69 represents the 4-furrow balance plough carried on two wheels, with the ploughman holding the guide apparatus—the two drums, one of which carries the pulled end of the rope, and the other the dragged or slack rope. The chain by which the one

Fig. 69.



Fowler's Plough.

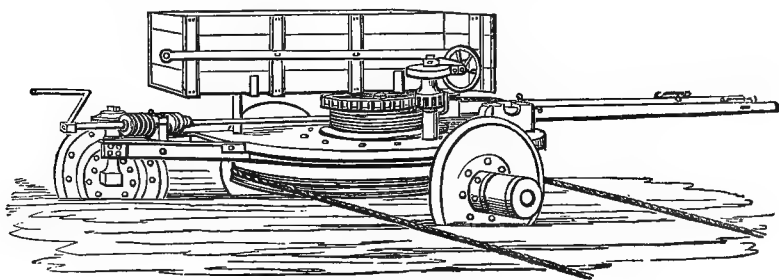
drum pulls upon the other, so that the draught of the plough keeps the slack rope tight, is also seen.

It will be understood from what has been already said, that the rope from the engine clip-drum is carried round a horizontal pulley in an anchored framework on the other side of the field. Fig. 70 represents this travelling anchor. It is a low frame on sharp

wheels, which sink into the land, three on the farther side, and one on the near side to the engine. The horizontal pulley carrying the draught rope of the plough can be made to actuate the upper wheel, and so wind up the rope coiled round it, which is anchored at a distance along the headland, and so pull the anchorage along, and keep it opposite the engine.

The handle and shaft carrying a spiral thread, seen in the drawing, enables the anchor man to alter the position of the anchor wheels or discs, and thus guide the apparatus along a sinuous headland, while the slack gear apparatus on the plough ensures the rope being let out and taken up as the furrow lengthens or shortens, in accordance with the altered pathway of the anchorage.

Fig. 70.



Fowler's Moving Anchor.

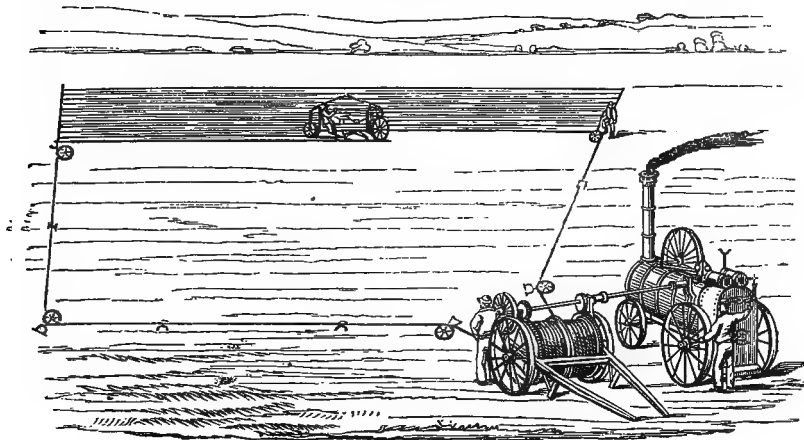
In fig. 71 we have a diagram of the way in which Messrs. Howard manage the work of steam culture. Their engine is planted in a corner of the field, and works a double windlass, on which either end of the rope is wound alternately, and thus the implement is drawn to and fro along its furrow between anchors at either end, which are shifted bodily by a man.

The drawing should have shown the two men required, one at each end of the furrow, and the rope should have been shown more obviously in its position around the anchorage or snatch-block pulleys, and around the quadrangular space of the field yet unploughed, that is being tilled.

Fig. 72 represents Howard's 2-furrow plough. The framework on which the ploughman sits is lifted by the levers out of the ground at the end of the furrow, turned upside down, so as to bring the other pair of mould-boards into operation, and dropped into work again. The man has within easy reach levers by which he can alter the direction of the implement, and the depth of its operation. Although a compendious and well-packed apparatus, it is the fault of this plough that its position depends on that of wheels at either end and far apart. Unless, therefore, the ground be perfectly true, the work must be uneven as to depth.

We have not thought it necessary to give drawings of the Woolston apparatus. Mr. Smith's machines are 5 and 7 tine

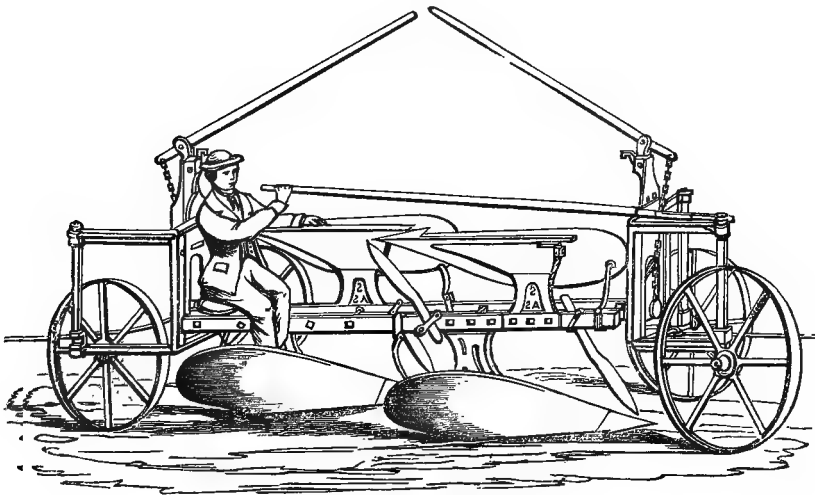
Fig. 71.



Howard's Engine and Windlass.

grubbers, for the purpose of stirring the land. They are worked just as in fig. 71, except that, instead of a shaft from the engine to the windlass, the latter is worked by strap from the fly-wheel or fly-wheel shaft of the engine.

Fig. 72.



Howard's Two-furrow Plough.

II.—FIELD WORK.

The ploughing of stubble should be completed; and that of lea for oats and beans should be finished as soon as possible. This and subsoil-stirring may be done either by steam-power or horses; in either case it ought to be done before winter.

Claying and marling is work proper for the winter months; though if it can be completed before the frost has left, so much the better. The subject has been already referred to in these pages (see Index): let us, however, quote an actual experience on peaty and light land soils, thus described by Mr. Almack, in the *Agricultural Society's Journal*. He says:—I have no hesitation in saying that the value of many millions sterling is buried under what is now comparatively unproductive soil, in England alone. As an instance, I was shown in Norfolk what a gentleman called his "hidden jewel," so near the surface, that one plunge of his walking-stick convinced me it would be practicable to bring up sufficient by merely ploughing deeply with the common plough the first time he broke up the land, which he said he intended doing immediately after the tithe-rent charge was apportioned. On the surface was light "fen," to a common observer apparently of little value, yet immediately below was the valuable slate-coloured clay, ready for its improvement. In the fens near Downham this clay is from 4 to 6 feet below the surface. Pits are dug about 6 feet by 3, and 3 feet apart, in rows, generally two rows in a chain (of 22 yards), and they take out two or three spits deep of clay from each pit. In digging one pit, part of the peat is put in that which was last made. The cost varies; being under or over 50s. per acre, according to circumstances; but it is very well repaid by the crops of red clover, wheat, and beans which the land will afterwards grow.

The farm of Mr. Cambridge, of South Runston, may be named as a favourable specimen of what has been done for the soil of Norfolk, and to account for its present productive state; but so far from being a solitary instance of such improvements, the practice has been almost universal throughout the county, the quantity of clay applied varying according to circumstances. 54,055 loads of clay have been applied on this farm to 286 acres, or, on an average, 188 loads per acre. Mr. Keppel, of Lexham Hall, has made great improvement in his light sandy land, by claying at the rate of 50 loads per acre. Near Swaffham I observed some men claying a field from a pit nearly in the centre of it; they were paid at the rate of one halfpenny per barrowful, or 7d. per "load;" their orders being to apply 80 such loads per acre; making the cost of it under 50s., though the work was done without the use of horses; employment

was thus found for more labourers, without fear, too, of injury to the land by its being cut in using carts when not sufficiently dry.

Chalk, also, as well as clay and marl, may be dug and spread on light sandy soils in the winter months.

Fences give some work to do in December. It is well to plant the quicks for young fences as early as possible in the winter months—though February will also do very well—and to postpone the cutting back and relaying fences till February, though this work is described in the month of January.

The following are good remarks by Mr. Martinson, before the Newcastle Farmers' Club. He says:—The ground intended for a line of new fence should undergo deep ploughing or trenching at least twelve months previous to planting, and have all the weeds and rubbish as nearly as possible eradicated; and a little lime might be advantageously employed in decomposing any vegetable matter which may remain. The stem of each plant, before being deposited, is cut through to about 6 or 8 inches long, and then these plants are placed as firmly as possible in their bed; a furrow with the spade being made, in which the plants are inserted; the roots are covered with soil, and that soil compressed by the foot, more mould being applied to fill the furrow. A sharp knife is used in cutting off the stems close by the surface, and you cover these cuts with a very light sprinkling of earth, merely to preserve them from frost. They come away beautifully in the spring after being planted now. About 7 or 8 plants to a yard are enough. One advantage of this mode of planting is, that much less room is required, as you dispense with the usual cast or mound, and you can cultivate and crop your land much nearer to the fences. This mode may be objected to on wet land; but such land should be drained, and that not by an open ditch along the line of fence, but by a systematic underground drainage. The proper season for planting is from about the middle of October till the end of March, or during the inertness of the sap.

The thorns being now planted, it is desirable, and necessary, that they should be protected from injury by the trespass of cattle and sheep. The best protection is wooden railing. This precaution should be taken immediately on the completion of the fence, or, at least, before any animals have access to it. The protection of these young hedges by railing is expensive, but yet I am certain that the young hedges come to perfection much sooner when thus protected. The hedge being planted and protected, great care is to be exercised in opening out those thorns in spring which have been covered up. This is best done by loosening the earth with the hand, or with a small stick; and lest injury be done in this way to the buds, neither a spade nor any other sharp instrument ought ever to be used in this operation. The most essential point afterwards is to keep the plants clean and free from weeds.

Mr. Martinson adds:—I have endeavoured to ascertain the best time for cutting old hedges, in order to secure the quickest growth, which is a very desirable object. I have found that those cut from about the middle of February to the end of March have shot away again most vigorously, whilst those cut from November to the beginning of February have been much more tardy in shooting forth, and their shoots have been neither so strong nor so numerous. In these cases the hedges were much the same in appearance and age previous to cutting. I am therefore determined to confine the time of cutting, in future, from the beginning of February to the end of March, or to cut as nearly as possible to the rising of the sap, and then the cuts or wounds have not so long to struggle with the inclemency of winter storms.

One further remark we add:—However partially I may have spoken of thorn hedges, there is one particular place on the farm where they should never be planted; that is, around the stack-yard. That fence ought always to be a stone wall.—Hedgerow trees ought never to be planted in thorn fences. Nothing is more destructive to their growth; nor anything more prejudicial to adjoining crops.

Carriage of dung to the fields is work for frosty weather, as also the carriage of materials for roads and drainage, both of which works, as already named, proceed vigorously during winter. During winter dung may be carried direct from the yards and spread upon the land to which it is to be applied, leaving it thus broadcast without fear, during the cold wet winter's months, of any loss by evaporation or fermentation until it is convenient to plough it under.

Odds and ends.—Perhaps the best illustration to be offered under this head is to be taken from the report of a South Hampshire farm, already quoted often in these pages.

“December 6th.—We have lately been engaged in wheat-sowing, threshing pease, carting pond-mud, and mixing with town and cottage manure, in readiness to apply to the pastures in January or February; cutting and making hedges, and grubbing old banks, for the purpose of enlarging our fields, some of them being not more than three or four acres each. Some of our men are busily employed threshing barley, the straw being now in request for fodder. Our shepherds are getting very busy, this being the height of our lambing season; we have upwards of thirty Down lambs, amongst them many twins. Our horn ewes are also lambing very fast, being very prolific, the greater part producing twins, the rearing of them requiring great care and attention; but we are well provided with a sheltered lambing yard and shed seventy feet in length, which has throughout a rack for hay feeding, and manger for cut swedes. We bed our yard and shed with earth or dried peat, about six inches in depth, and then continue to litter with dry straw, as cleanliness requires. The ewes are receiving a change of Italian rye-grass,

with a few swedes carted on to the wheat eddishes, and at night are driven to the lambing yard, where they receive hay.

"December 18th.—The horses and some men have been carting dried peat, which was stacked last summer, into the cattle-boxes, which we find an excellent absorbent for the liquid manure, as when it is put in perfectly dry, and broken down fine in the pens, it comes out after a few months valuable manure; for peat, unlike other kinds of earth, being composed only of decayed vegetable substances, does not often contain seeds of weeds. We have found this peat manure answer the best when applied to strong soils. We commenced ploughing the wheat stubble land for the next year's crop of swedes on the 10th December, with two horses for each plough. Some may consider this quite late for ploughing stubbles; but we find that where seeded with Italian rye-grass, the land gives abundance of good food for sheep. Some of our men have been engaged in taking up old tile drains, which some years since were placed about five feet deep in the old ditches; but we find it to be a bad plan, as the roots from the hedge get down into the tiles and choke the drain. In the present instance, we intend to remove the hedge, and relay the drain in the same place; otherwise we should place the drain at a greater distance from the hedge, if it was required to remain for a fence."

The Hop Farm.—Throwing and sorting hop-poles in fine weather regularly progresses through the winter. On wet days the men are employed in cutting rags, or preparing other manures. Other work is generally at hand in grubbing up old hop-grounds, cutting larches, draining and trenching.

Marketing.—The threshing of grain proceeds during winter both for the supply of straw and the yards, and for conversion of produce into money (see Index). The carriage of grain to market is one chief employment for the teams in winter.—Fat cattle and sheep are sold now and at all seasons when ready for the butcher.

III.—LIVE STOCK MANAGEMENT.

We have nothing to add here to remarks already made in these pages as to stable management during the winter months.

Cattle-feeding proceeds as already described. The following memoranda made this month on a well-managed arable farm in Bedfordshire describe ordinary good practice:—

"The fattening sheep in the turnip fold receive a daily allowance of 1 lb. of corn, with as many turnips and as much chaff as they can consume. The fattening cattle receive daily about 6 lbs. of corn each, a bushel, or rather more, of turnips pulped, with about 20 lbs. of hay and straw chaff. The whole is mixed and given in a prepared state. One man and two boys attend to 32 beasts in the stalls, and

45 store cattle in the yards, which have some turnips along with their dry food. The store cattle have a few hours' run in the fields daily, when fine. The milch cows also get into the fields in good weather, and live principally upon hay and a few roots. The horses have a weekly allowance of 3 pecks of beans, 1 bushel of rice-meal each, with as much hay and straw chaff as they can consume. Every man feeds, grooms, and works two horses on all ordinary occasions. Both labourers and horse-keepers breakfast now before going out at 7 o'clock. The chief employment of the horses and men for some time to come will be ploughing and carting dung, according to the weather, threshing and dressing corn, cleaning out water-courses, &c."

Calves may be coming in December—the treatment of the cow and calf is described elsewhere (see Index).

It is proper to remark here of abortions, that when they happen it is well to remove the cow at once and all signs of its misfortune from the midst of its fellows. It may be added too in reference to the cause of slipping calf that it has been attributed to the cow feeding on ergotted grass. Ergot is a disease which affects the seed of various grasses, and it is known to have a strong medicinal influence of this kind. All bents in cow pastures should be mown down early in autumn for the avoidance of this risk.

Dairy Work is now generally at a close. Winter cows are generally unprofitable. If any have already calved, they must be fed on pulped or steamed roots, along with hay chaff, and a little bean-meal. The pulping of the roots tends to the removal of that aroma which becomes otherwise, in the case of turnip-feeding especially, disagreeably present in the milk and butter. Calves and young stock are to be housed warmly, and fed on roots and straw, either pulped or whole—a little oilcake is generally a profitable daily food for growing cattle.

The Flock.—The fattening sheep continue, whether in the fold or in the yard, to receive the same good food and treatment already described.

The earlier breeding flocks begin to drop their lambs towards the end of the year; and as already said of the Hampshire farm, the horned ewes have lambs now many weeks old.

Mr. Blundell, of Southampton, speaks very highly of the Belgian carrot as food for them. He says:—

Having noticed the great value of the white carrot for the feeding of horses and pigs, I was induced to commence an experiment for the purpose of proving the value of this root for the feeding of early lambs, as compared with that of the Swedish turnip. I began with giving the carrots, cut with Gardner's machine, in troughs placed side by side with others containing Swedish turnips, cut with the same machine, in advance of the

hurdles, in the usual manner; and I found, in the course of a day or two, that the lambs had so great a preference for the carrots that they ate no swedes so long as any carrots remained in the troughs; in consequence, I discontinued giving any cut swedes whilst I had any carrots for use, they having continued in good condition until the 1st of April. Finding my early Somerset lambs doing so well upon carrots, I decided upon feeding the South Down lambs in the same manner, and the result was precisely the same, they having refused to eat any cut swedes, when they could get carrots. I had no means of proving with accuracy the difference in the quantity of carrots and swedes consumed by a given number of lambs, neither did I attempt it, considering their great liking for the carrot quite conclusive; although I believe a lot of lambs would consume a greater weight of swedes than of carrots. The quantity of hay consumed was about the same as in former seasons, when feeding with Swedish turnips. But I was struck with the apparently diminished quantity of corn and cake consumed by the lambs whilst feeding on carrots; I therefore determined upon ascertaining the actual quantity of oil-cake and pease consumed by a lot of 100 lambs whilst feeding on carrots, as compared with former seasons when feeding on swedes; and having in previous years found that 100 lambs, being allowed as much as they could eat, consumed on the average four gallons of pease and twenty-six pounds of oilcake per day, for a period of nine weeks, commencing at five weeks old, until they were fourteen weeks old, being at that age fit for sale; I then found, to my surprise and satisfaction, that 100 lambs, being fed *ad libitum*, only consumed two gallons of pease and fourteen pounds of oilcake per day (having at the same time the usual allowance of hay and as many carrots as they would eat), or, in fact, about one-half the quantity usually consumed before commencing the experiment of carrot-feeding. The advantages to be derived from feeding lambs with carrots, I find, consists in the saving of one-half the cost of oilcake and corn, and in the lambs being fit for the butcher earlier, and attaining a greater weight and better quality at a given age, than when fed on any other root. In proof of which, I have never, during a period of more than twenty years, sold lambs so fat and heavy at the age as those which I have fed during the progress of this experiment, and in the manner here described.

The treatment of fattening early lambs has been already described.

In the moorlands of the north the ewe flock are treated very differently. The following is the report from the Lammermoor farm:—The bathing of the sheep was completed on the 17th November, and the jackets were all got on the hogs by the 22nd, on which day the rams were turned out to the ewes. As we do not hirsle (arrange in separate flocks) our sheep, but allow them to dis-

tribute themselves equally over the ground, we only allow 45 or 50 ewes to each ram. With more than this number, barren ewes are apt to be too numerous. We think it better not to put a ram to the same ewes more than one season, experience showing that the first cross takes most to the sire, and the second to the dam, and as the former is supposed to have been well selected, and to possess at least some properties superior to the ewes, it is well to avoid whatever may retard the general improvement of the stock; especially when it can be so easily avoided, even on our open ground, by the shepherd putting a sheep to those ewes which graze the opposite side from where he was the previous season. As the progeny of a shearling ram are considerably more vigorous than those of a three or four shear, we endeavour to have the majority of our number of the former age, though a really superior sheep will never be laid aside until he is inefficient from age. Such of the cast ewes as were unfit to be sold for breeding are getting turnips, and about half-a-pound of oats daily, with the view of fattening them, and getting them off as quickly as possible. During severe weather, their allowance of oats will be increased.

IV.—FARM CAPITAL.

Money is needed by the farmer in the prosecution of his business—(1) for the payment of rent and taxes for the land he hires; (2) for the purchase and maintenance of implements, draught animals, and steam power, needed for the cultivation of the land and the conversion of its produce; (3) for the purchase of seed and manure; (4) for the payment of labour during the year; (5) for the purchase of live stock by which to consume the green crops of the farm, and by which to provide the home supply of manure, on which its fertility must depend. It is plain that the amount which is made up of these items will vary exceedingly with the circumstances of the farm.

Thus (1) rent may not be asked for out of capital at all; the landlord may give, and often does give, twelve months' credit, asking for it directly (as he necessarily always does, essentially) out of the produce of the land, not out of the capital which the tenant brings on it. Rent, moreover, whether long credit be given for it or not, varies between wide limits, according to the quality of the land. It may be 15s. or 20s. an acre, or it may be 40s. or 50s. an acre; it may, indeed, vary from 5s. to 5% per acre, according to the fertility of the land, and its neighbourhood to good markets.

And (2) the amount needed for the purchase of farm implements and draught animals, it is plain, must vary with the quantity of work needing to be done. Stiff clay arable land, cultivated highly, needs more costly equipment in this way than lighter, poorer soils

more easily cultivated, which are probably two years out of every five laid down in grass. And both need larger outlay on implements and power than pasture land requires. The implements of arable land will cost from 15*s.* to 25*s.* an acre, and the horse-power probably from 15*s.* to 30*s.* an acre more. This supposes steam-power to be *hired* for threshing purposes: if it be provided for steam-cultivation (a 12-horse power engine and apparatus then displacing 12 or 14 horses and their implements) something more must be added under this division.

(3) The amount required for seed and manure is also extremely variable. From 10*s.* to 20*s.* per acre will be needed for clovers and grain crops, and from 2*s.* 6*d.* to 10*s.* for root crops; probably from 8*s.* to 16*s.* on the whole arable land will be needed for the former: while for the latter the sum required varies from nothing up to as much in many cases as another rent, according to the spirit of the farmer and the proved experience of the locality. There are many farmers who pay 1*l.* per acre annually for artificial manures.

(4) Labour varies from 4*s.* or 5*s.* per acre on grass lands, up to even 50*s.* an acre on arable land. In the "Handbook of Farm Labour"* particulars are given of farms amounting in all to 7824 acres of arable land, and 1690 acres of pasture. The wages paid on these farms were 14,323*l.* per annum; or, deducting 423*l.* for the pasture land, 33*s.* an acre over the ploughed land.

(5) The capital needed for provision of the live stock of the farm, and for extra food purchased for them, is the last item on the list: and this obviously must vary exceedingly with the fertility of the land, the energy of its cultivator, and the rotation of crops adopted. Even in the case of pasture lands, where the natural fertility of the soil is the leading point, it varies from 2*l.* or 3*l.* per acre, up to 12*l.* or 14*l.*; the grass, in the former case, being fit for little more than a store sheep or two per acre, and in the latter, feeding annually a heavy bullock. On plough-land the influence of different rotations must tell; the quantity of meat made annually under them is shown at pages 526, &c., to vary from thirty lbs. up to one cwt. per acre. In the former case, it is plain that the stock will not need to be more than a sheep to every acre, or one to every one and a half acre, while, in the latter, it may be equal to two or even three sheep per acre throughout the year. But the calculations there referred to were not built on the more economical processes, now adopted in the meat manufacture, of pulping and steaming roots, and cutting straw into chaff, and using large quantities of oil-cake, &c., so that the estimate of capital needed under this head may vary from as little as 1*l.* or less per acre, up to as much as 5*l.* or more where heavy crops of roots and straw are grown, and double

* By J. C. Morton. Longmans.

green crops in the year are taken from the land and consumed upon it.

Adding the items together which we have been considering, the capital required per acre on our arable lands comes out equal to from 7*l.* to 15*l.* per acre.

Of these sums a varying portion will be payable on entering the farm, as a valuation of the outgoing tenant's property then taken. The latter will have spent for his successor various amounts under most of the headings on our list. He may have paid for labour and for seed and for manure upon certain portions of the farm, and he may hand over by valuation certain portions of the implements and live stock he has been using. Of the remainder, a varying portion under most of the divisions of the whole will not need to be paid until after harvest time, when means may be provided for the purchase of live stock, and for the payment of rent, by the sale of grain. In this way the immediate burden of the demands upon the farmer's purse is considerably reduced.

Nothing has been said of the cost of permanent improvements of the land, which are properly a landlord's operation; but which, if the tenant be secured for long enough in his occupation, may be profitably undertaken by the latter. Almost unlimited scope for the profitable application of capital to land is thus provided over a great extent of the island; and the influence of the "lease" in leading thus to the high cultivation of the land, has been already referred to in these pages.

Let us add, as a last word on farm capital, that it is the interest of the farmer, however it be invested, to insure it to its full amount against all the risks of fire, disease, and death, which will be accepted for him by insurance companies, on the payment of an annual premium.

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